VOLUME 1
NOS. 1 & 2
JULY - OCTOBER 1976

FIRE TECHNOLOGY ABSTRACTS

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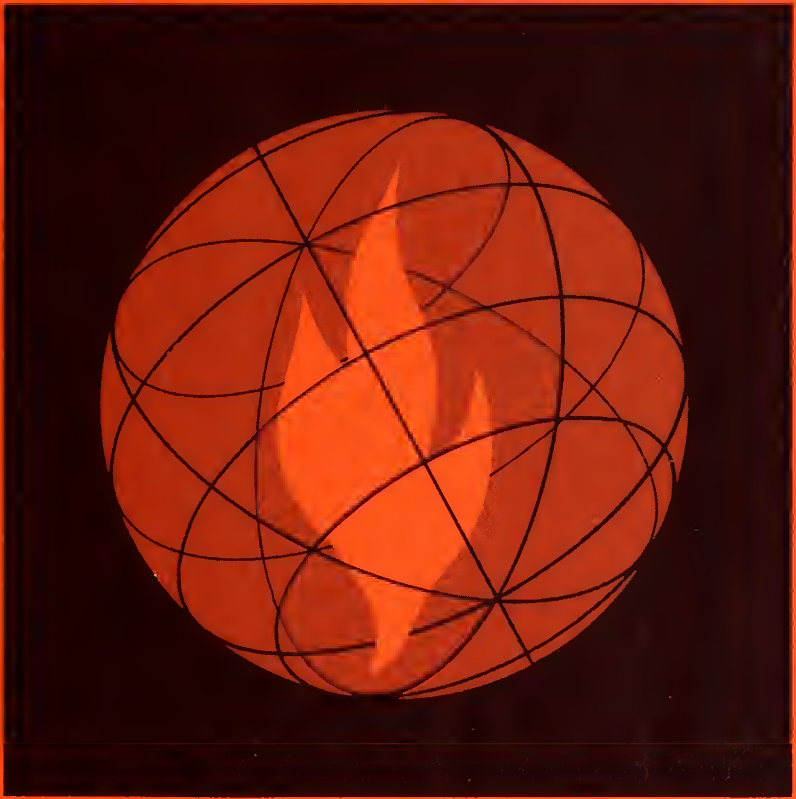

U.S. DEPARTMENT OF COMMERCE
National Fire Prevention
and Control Administration

NOTE . . .

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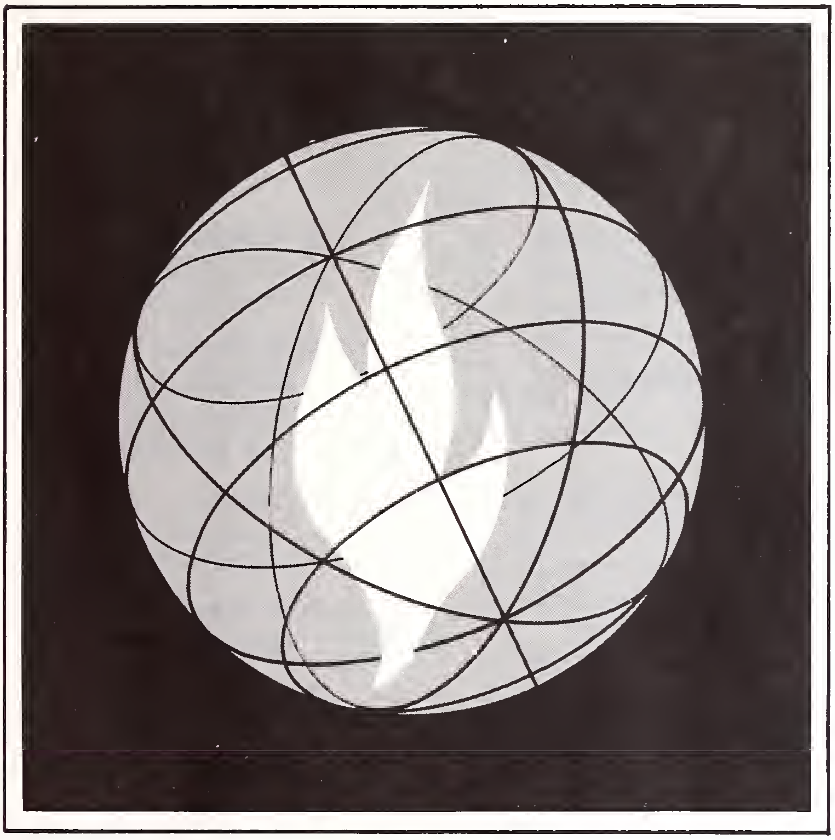
FIRE TECHNOLOGY ABSTRACTS



U.S. DEPARTMENT OF COMMERCE
National Fire Prevention
and Control Administration
The National Fire Reference Service

Prepared by
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The Johns Hopkins University

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TABLE OF CONTENTS

1. GENERAL
   - a. Fire Protection Organization......3
   - b. Meetings and Professional Activities..........................4
   - c. Literature and Notices...........5
   - d. Fire and Explosion Incident Critiques and Analyses.........7
   - e. Fire Science Education...........12
   - f. Legislation......................12
   - g. Research and Development Programs 12

2. DYNAMICS AND MECHANICS OF FIRE
   - a. Fire Buildup, Propagation, and Spread.......................14
   - b. Flammability, Ignition, and Extinction.........................18
   - c. Flow of Combustion Products......23
   - d. Instrumentation..................24
   - e. Meteorology......................25
   - f. Radiation........................25
   - g. Thermal Conductivity.............26

3. BEHAVIOR AND PROPERTIES OF MATERIALS
   - a. Characteristics and Thermal Behavior of Materials...........26
   - b. Combustion and Flammability Tests and Methods..................29
   - c. Fire and Explosion Hazards of Materials.....................32
   - d. Nature of Combustion Products....34
   - e. Protection and Modification of Materials.....................38
   - f. Stability of Materials at Elevated Temperatures..................40

4. FIRE MODELING AND TEST BURNS
   - a. Field Evaluation.................43
   - b. Fire Testing, Structures.........45
   - c. Modeling and Scaling.............49
   - d. Systems Behavior.................51

5. FIRE PROTECTION PRINCIPLES
   - a. Building Design and Construction Principles...................52
   - b. Detection and Alarm Equipment....53
   - c. Fire and Explosion Risks.........58
   - d. Fire Loads.......................59
   - e. Heat and Pressure Load Effects on Structures...................60
   - f. Prevention and Hazard Reduction..62
   - g. Suppression Devices and Equipment 64

6. FIRE SAFETY
   - a. Agriculture and Forestry.........78
   - b. Commercial Occupancies...........79
   - c. Electrical.......................80
   - d. Industrial Occupancies...........81
   - e. Mining...........................83
   - f. Power Plants.....................87
   - g. Public Buildings.................87
   - h. Residential Occupancies..........88
   - i. Transportation (Air, Rail, Road, Water)........................89

7. FIRE SERVICE ORGANIZATION AND FACILITIES
   - a. Administration and Management....97
   - b. Education and Training...........98
   - c. General Equipment...............101
   - d. Information Systems.............103
   - e. Investigation and Reporting.....103
   - f. Personal Equipment..............104
   - g. Personnel Affairs...............107

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION
   - a. Communications and Signalling...107
   - b. Extinguishing Agents and Additives 108
   - c. Hydraulics and Water Supplies...115
   - d. Inspection......................115
   - e. Operational Problems............115
   - f. Public Education and Public Relations........................116
   - g. Rescue Operations...............117
   - h. Tactics.........................119

9. PLANNING
   - a. Budgeting.......................120
   - b. Logistics.......................120
   - c. Operations Analysis.............124

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

a. Arson...........................125
b. Combustion Toxicology..........126
c. Emergency Medical Services and Facilities..................131
d. Injuries and Fatalities........133
e. Physiology.....................135
f. Psychology.....................137

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

a. Codes..........................137
b. Hazards Identification.........138
c. Safe Handling of Hazardous Materials..........................138
d. Standards......................139

12. INSURANCE, ECONOMICS OF LOSS AN
PREVENTION

a. Insurance...................14
b. Losses......................14
c. Risk Management.............14
d. Salvage.....................14

13. STATISTICS....................14
AUTHOR INDEX...................I-
SUBJECT INDEX..................I-
SOURCE INDEX...................I-3
REPORT NUMBER INDEX............I-4

FIRE TECHNOLOGY ABSTRACTS

Fire Technology Abstracts is an abstracts journal being prepared bimonthly by the Fire Problems Program Group of the Applied Physics Laboratory of the Johns Hopkins University, Laurel, Maryland, USA under the sponsorship of the National Fire Prevention and Control Administration (NFPCA) of the US Department of Commerce. It complements the Fire Research Abstracts and Reviews published under the auspices of the US National Academy of Sciences/National Research Council in cooperation with the NFPCA.

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The aim of Fire Technology Abstracts is to provide comprehensive reference to he applied fire literature in the broad range of topics outlined in the "Table of ontents." Most topics are covered fully; a few topics, such as forest fires and ine fires, are referenced selectively, because they are covered systematically in ther specialized indexing and abstracting serials. For such topics an appropriate otice has been entered under the respective category.

The information contained in Fire Technology Abstracts has been gleaned from a ide variety of sources (journals, books, reports, patents, codes, and standards), ith particular emphasis on the report literature, for which referencing heretofore as been inadequate. Although the English-language literature comprises the majority f the entries, the coverage includes selections from the world fire literature, dentified in part through such sources as Safety in Mines Abstracts of the Safety n Mines Research Establishment (UK), the Soviet Abstracts Journal, Series 68, "Fire rotection," and the card abstracts issued monthly by the Fire Literature Documentation ection of the German Fire Technology Research Center at the University of Karlsruhe Fachdokumentation).

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The journal is arranged in two sections: Abstracts and Indexes.

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FIRE TECHNOLOGY ABSTRACTS

Volume 1, Number 1/2 July-October 1976

1. GENERAL

a. FIRE PROTECTION ORGANIZATION

1. Janes DF
INTERFACES AMONG FIRE PROTECTION AND SAFETY PROFESSIONALS
Professional Development Conf, Proc; 1975, Jun 23-25, Denver, CO, pages 61-67
Sponsor: American Soc of Safety Engrs, Park Ridge, IL

Comprehensive overview of interaction among safety specialists is presented and evaluated. 6 refs

2. Marion KM
POLICE/FIRE CONSOLIDATION: FIRE/POLICE PATROL IN CLIFTON ANALYZED
Fire Chief, 20(4):62-64, 1976

A combined fire/police patrol program has been in effect in Clifton, NJ, since 1967. The Fire/Public Safety Department is administered by the fire department and operates out of six stations. It operates under the following activity assignment priority schedule: firefighting and protection, in-service fire company inspections, training, equipment maintenance, and public safety fire/police patrol. Fire protection in all its phases is maintained at a high level of effectiveness. The author believes that the increased physical and psychological interaction between citizens and firemen, firemen and policemen, can only help maintain a high level of efficiency and effectiveness with regard to the common duty of serving and protecting the public. 5 refs.

3. Holmgren RB
POLICE/FIRE CONSOLIDATION. SIX REASONS WHY YOU SHOULD NOT CONSOLIDATE
Fire Chief, 20(4):59-61, 1976

The author cites a six-point program to convince city officials that a separate fire department is crucial to the community. The six points are 1) in-station maintenance of equipment and facilities, 2) training, 3) fire prevention, 4) prefire planning, 5) non-fire emergency, and 6) actual fire duty. The points should be put across in an active public relations program.

4. Clark JE
THE NATIONAL FIRE PREVENTION AND CONTROL ADMINISTRATION; Paper No. 17
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

The events leading to establishment of the Nat Fire Prevention and Control Admin within the Department of Commerce are described. This organization, together with the Center for Fire Research at the

1. GENERAL

a. Fire Protection Organization

Nat Bureau of Standards, assumes a leading role in federally supported work on fire safety. The various components or offices of this organization are described. One of these, the Nat Fire Safety and Research Office, is actively engaged in identifying the national fire research needs and implementing studies on them. It is also supporting development of procedures for community master planning for fire safety and programs for development and demonstration of new equipment and methods for achieving increased safety and effectiveness of fire fighting procedures. A Nat Fire Data Center has been established to continually monitor and provide a means for studying field fire experience. The system being developed is designed for use by the local, regional and national groups concerned with identification of new problems and efficient fire control and fighting procedures. A public Education Office and a Fire Academy are in the planning stages and will ultimately provide a means for more effective education and training information for achievement of increased fire safety. (Author's Abstract)

b. MEETINGS AND PROFESSIONAL ACTIVITIES

5. Anon
FIRE TECHNOLOGY FORUM
Fire, 68(851):612-613, 1976

The first of the planned series of technical forums, organized jointly by the Fire Protection Association and the Institution of Fire Engineers (UK), was held recently at London's City University. The object was to keep designers, insurers and planners of buildings, processes and plants abreast of the latest developments in fire technology. The forum was a one-day session, at which four separate problems were discussed: roof construction; reinstatement versus rebuilding of fire damaged buildings; assessing material hazards; and assessing flow rates of liquids and vapors from fractured pipes. The forum was attended by some 80 chemical, mechanical and structural engineers, building designers and architects, fire officers and others with insurance and risk management interests or fire problem concerns. Future forums are planned. 1 fig.

6. Anon
INTERNATIONAL VIEWS ON SAFETY OF COMBUSTIBLE MATERIALS
Fire, 68(847):416-418, 1976

The 42 papers presented at the International Symposium on Fire Safety of Combustible Materials held at Edinburgh, Scotland, in Oct 1975, are reviewed. These papers will be individually reviewed in the next issue of _Fire Technology Abstracts_.

7. Anon
DESIGN FOR FIRE SAFETY
Fire, 69(852):43,45, 1976

The part played by the designer, fire service engineer, building materials manufacturer, fire officer and fire insurer in the development of fire safety in buildings was the theme of a two-day conference "Designing for Fire Safety" held at Nottingham University (UK) in April, 1976. Some of the papers presented were: industrial legislation for fire safety and the architect; the fire service and the architect; the insurance point of view; building materials and construction and their fire characteristics; design and control of fire and smoke spread; the challenge of designing for fire safety; and the control of fire in the design of the National Exhibition Center, Birmingham (UK).

8. DeMoulins P
MAINTENANCE OF FIRE PROTECTION
Fire Prot Conf, Internat; 1975, Apr/May, Amsterdam, pages 30-35
Sponsor: Conf of Prot Assoc Europe

Rules are proposed for the maintenance of fire prevention. They must take into account the age of the premises, carelessness, increase in fire loads, and deterioration, whether deliberate or unintentional. To achieve the objectives, the following procedures are proposed: 1) compilation of a technical record; 2) conservation of the building construction standards; 3) maintenance of the technical installations and safety apparatus and preservation of the protection standards, and 4) increasing the awareness of the occupants and training personnel. The provisions of these procedures are discussed and a fire prevention maintenance program is outlined.

9. Pfefferli W
SYMPOSIUM OF THE INTERNATIONAL COMMITTEE FOR PREVENTIVE FIRE PROTECTION AND EXTINCTION, 28 JULY to 1 AUGUST 1975, LONDON
Schweiz Feuerwehr Z, 101(11):464-470, 1975 (German)

The CTIF symposium was held simultaneously with the session of the British Fire Fighters Organization. The following topics were presented for discussion: safety, health and social security of firefighters; methods of delivering foam to extinguish burning oil products in tanks; transportation and storage of hazardous products; explosion in a chemical plant in England; training school children in fire prevention. Details of some of the problems discussed are presented. 4 figs.

10. Anon
FIRE PREVENTION CONFERENCE (NOTICE)
Fire Eng, 129(6):72, 1976

A national conference focusing on "The Dynamics of Fire Prevention" has been scheduled by the National Fire Prevention and Control Administration for October 18-20, 1976, in Los Angeles.

11. Anon
Toxicity and Physiology of Combustion Products Symp, Internat, Program; 1976, Mar 22-26, Skaggs Auditorium, Univ of Utah, Salt Lake City, UT
Sponsor: Committee Fire Res, Nat Acad Sci, and Flamm Res Center, Univ of Utah

This is a brochure announcing the program of the symposium, the objective of which is the development of a better understanding of fire injuries due to smoke poisoning, methodology in the assessment of combustion products, methodology in the determination of combustion products, and regulatory standards with respect to flammable materials which generate toxic combustion products. The Flammability Res Center of the Univ of Utah will be dedicated during the symposium.

12. Anon
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

This is a brochure announcing the final program of the symposium and giving abstracts of the 17 papers read at the symposium. The papers will be published in the proceedings of the symposium at a later date. The individual abstracts are separately entered.

c. LITERATURE AND NOTICES

13. Kuvshinoff BW and Jernigan JB
BIBLIOGRAPHY OF RANN-SPONSORED FIRE RESEARCH LITERATURE: TOPICAL REPORT. Johns Hopkins Univ, Applied Physics Lab; APL FPP TR20, NSF RA/E-75-039, 138 pages, Feb 1976

The entries in this bibliography represent the formal fire research documentation produced at 20 institutions under NSF-RANN sponsorship. This includes journal articles, symposium and conference papers, technical reports, theses and dissertations, and motion picture film. Progress reports, talks, and informal memoranda are not included. Entries are arranged alphabetically by author under these general headings for each institution. A list of principal investigators and their affiliations is included as an appendix. (Author's Abstract)

14. Jason NH
FIRE RESEARCH PUBLICATIONS, 1974. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-736, 11 pages, Jun 1975
Availability: NTIS COM 75-11018

"Fire Res Publications, 1974" is a supplement to the previous editions which covered the years 1969-1972 (NBSIR 73-246) and 1973 (NBSIR 74-511). Only publications prepared by the members of the Center for Fire Res (CFR), by Nat Bureau of Standards (NBS) personnel under contract or grant to the CFR, or by NBS personnel or external laboratories under contract or grant from the CFR are cited. Articles published in NBS house organs also are cited.

15. Hahl RG
DCPA FIRE RESEARCH BIBLIOGRAPHY. Defense Civil Preparedness Agency; DCPA RE-24, 39 pages, Jan 1976
Availability: NTIS

1. GENERAL
c. Literature and Notices

A short introduction to management of OCD fire research is provided. All documents produced by this program from 1962 to 30 June 1975 are listed and their scopes summarized. (Author's Abstract)

16. Anon
COLLECTED SUMMARIES OF FIRE RESEARCH NOTES 1974. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1034, 58 pages, Apr 1975

Summaries of 37 notes. [Safety in Mines Abstracts]

17. McKinnon GP (Ed)
FIRE PROTECTION HANDBOOK
Nat Fire Prot Assoc; 14th edit, 1296 pages, 1976

Technical development, code changes and new practices that have occurred in the seven years since the last edition are reflected in this 14th edition of the NFPA "Fire Protection Handbook." The text is illustrated with nearly 800 illustrations and diagrams.

The new edition has sections covering the gamut of fire protection and suppression from industrial hazards and building construction to fire department operations and extinguishing agents.

18. Anon
FIRE PROTECTION REFERENCE DIRECTORY
Nat Fire Prot Assoc, Boston; 1st edit, 160 pages, 1975

The fire protection reference directory includes a comprehensive listing of products with the names and addresses of manufacturers. The material has been arranged to provide quick location of product information and cross-checking to other references. Catalogs and data sheets are available from manufacturers at the addresses listed. (Author)

19. Obukhov FV
FIRE SAFETY. ABSTRACT SURVEY OF THE REPORTS OF THE IVth INTERNATIONAL FIRE PROTECTION SEMINAR (Pozharnaya Bezopasnost. Referativnyy Obzor po Materialam IV Mezhdunarodnogo Seminara Pozharnoy Okhrany)
Nedra Press, Moscow, USSR; 192 pages, 1975 (Russian)

The book contains abstracts of the research being conducted in a number of countries in the field of fire safety of industrial and public buildings and structures. The reader is apprised of methods and results of some current research, of principles for devising computational methods to evaluate the fire hazards of various kinds of buildings in the design stage, the fire-protection requirements for the design and construction of residential and public buildings (including high-rise), industrial establishments, atomic power plants and computer centers. The conclusions and recommendations presented in the book can be implemented in practical and research work. The book is intended for construction engineers (designers), scientists and technicians in fire protection and for other organizations engaged in design, construction, and in the development of fire safety standards and in checking on the fulfillment of these requirements. 62 figs, 26 tables. (Author's Abstract)

20. Zunde P and Gehl JM
FIRE-RELEVANT LITERATURE AND ITS AVAILABILITY
Inf Process Manage, 12(1):53-61, 1976

The primary goal of the National Fire Data Center, which was authorized by the US Congress on 29 October 1974, is "the selection, analysis, publication and dissemination of information related to the prevention, occurrence, control, and results of fires of all types" (Section 9a, Public Law 93-498). In pursuing this goal it was clearly necessary to determine the relevances and usefulness to fire researchers of the many computerized bibliographic data bases which already exist in support of science and technology, and to assess the extent to which existing computerized bibliographic data bases can provide information relevant to fire research. We describe here the results of a study which was directed at this particular problem. 8 tables, 2 refs. (Author's Abstract)

21. Vervalin CH
FIRE/SAFETY INFORMATION RESOURCES
Hydrocarbon Process, 54(8):65-6, 1975

Knowing where to look for fire/safety resources is the key to building a good in-company program. The references and citations given offer everything the HPI safety professional needs in this regard. In addition, this wrapup is followed by six articles that deal substantially with major problem areas in fire/safety. (Author's Abstract)

d. FIRE AND EXPLOSION INCIDENT CRITIQUES AND ANALYSES

22. Best R
THE SEMINOLE COUNTY JAIL FIRE
Fire_J, 70(1):5-10,17, 1976

A prisoner-ignited paper fire spread to polyurethane mattresses, creating a rapid buildup of intense heat and toxic smoke, resulting in the death of 10 prisoners and a correctional officer. The structural condition of the building, the mattresses and storage area, and origin of the fire are discussed and analyzed. Careful development of pre-safety operating and maintenance procedures are recommended. 3 figs, 4 photos.

23. DiMeo M
FIRE IN A PENNSYLVANIA PRISON
Fire_J, 70(3):70-76, 1976

Six juveniles in a detention cell, apparently wishing to cause a small disturbance, piled their mattresses, some of them 100% polyurethane foam, in the middle of their cell and ignited them. Within minutes after ignition, a heavy black acrid smoke filled the room and took the lives of three of the six juveniles. The progress of the fire and rescue efforts are described. Fire safety measures are proposed. 8 figs.

24. Anon
LESSONS OF A HIGH-RISE FIRE
Fire_Internat, 5(51):59-64, 1976 (English, German, French; Spanish abstract)

The effects of modern construction practices on the fire safety of high-rise buildings are evaluated in a New York Board of Fire Underwriters' report on a fire in one of the Twin Towers in the World Trade Center office building complex in New York City. The construction practices which come up for particular criticism are foam wall insulation, compromise of floor and wall fire resistance by permitting openings to be made in them, the failure to install detectors in return air shafts, vertical shafts around columns without firestops, unsuitability of light-weight wall components as fire barriers, firestopping of wires and cables and fireproofing of the insulation, and others. Combustible plastics in equipment and furnishings are identified as the fire load hazards. 1 fig.

25. Nash P
THE EXTINCTION OF AIRCRAFT CRASH FIRES
Fire_Prev, (112):24-30, 1976

The aircraft crash fire is one of the most severe fires in human experience owing mostly to the highly volatile liquid fuel load. The problems of aircraft crash fires, the rate of development and intensity of major aircraft fires, crash fire statistics in the UK, the development of crash fire extinguishing agents, foams and their characteristics, research on aircraft fires, and the design and development of aircraft crash fire appliances are the topics examined in this article. 10 figs, 8 refs.

26. Anon
FIRES IN LEISURE BUILDINGS
Fire_Prev, (112):35-41, 1976

Leisure buildings, among them cinemas, bingo halls, clubs, pier buildings and sports stadia, can be major fire risks. A survey is made of seventy-nine serious fires in the UK between 1965 and 1974. The main lessons which emerge from the Fire Protection Association are: careless smoking is the most common cause of the fires; since the majority of serious fires occur during closed periods, automatic sprinklers or automatic detection systems could reduce fire losses; and combustible construction is the factor which contributes most to the development of the fires. 8 tables, 2 photos.

27. Perry LB, Gould AB and Leonard PF
CASE HISTORY NUMBER 82, NONFLAMMABLE FIRES IN THE OPERATING ROOM
Anesth_Analg, 54(1):152-4, 1975

A 50 year old man was scheduled for suspension laryngoscopy and removal of a laryngeal polyp. Anesthesia consisted of an induction with thiopental followed by maintenance with enflurane and oxygen insufflation, supplemented by bilateral block of the superior laryngeal nerves and translaryngeal injection of a topical anesthetic. Following insertion of the Killian Lynch suspension apparatus, the polyp was excised, and the base coagulated by means of a Bovie electrosurgical unit. At this point, there was a flash of fire in and around the mouth; the fire was promptly extinguished with water and by discontinuing the oxygen. The patient sustained second degree burns of the oral mucosa and lips, but these healed uneventfully. It was later determined that, in the presence of a high oxygen concentration, the tape used to protect the teeth had been ignited by the arc from the electrosurgical unit and had burned vigorously.

28. Snow JC, Norton ML, Saluja TS and Estanislao AF
FIRE HAZARD DURING CO(2) LASER MICROSURGERY ON THE LARYNX AND TRACHEA
Anesth_Analg, 55(1):146-147, 1976

Within the last six months, four patients sustained burns of the tracheal mucosa from the impact of a CO(2) laser beam on the endotracheal tube during microsurgery. In all four cases the fire was extinguished promptly and the burns healed uneventfully. Two of the cases are described in detail. 3 refs.

29. Son EG and Lupanova LI
ANALYSIS OF STATISTICAL DATA ON FIRES IN COMMERCIAL WAREHOUSES
Vopr_ekon_pozhar_okhrane, (3):73-81, 1974 (Russian)

An analysis of statistical data on fires in commercial warehouses has shown that wide use of automatic fire-protection installations makes it possible to reduce fire damage appreciably. It is planned to reduce the fire damage in commercial warehouses by 69 million rubles in 1974-75. (Author)

30. Harder HJ
FIRE AND EXPLOSION HAZARDS IN ANESTHETIC AND SURGICAL DEPARTMENTS
Prakt_Anaesth, 10:192-203, 1975 (German)

Since flammable anesthetics are only rarely used at the present time, the possibility of fires and explosions is low. The frequency of accidents caused by flammable colon gases and disinfectants has remained essentially unchanged. But a new kind of accident can and has occurred, namely, fires and, occasionally, explosions from "nonflammable" anesthetics. A survey of 16 such cases (including oxygen fires) should be of interest to surgeons and intensive-care personnel as well as anesthetists. 2 figs, 5 tables, 31 refs. (Author)

31. Campbell JA
FLASH FIRES WITH HIGH FLASH POINT LIQUIDS
J_Chem_Educ, 52(2):A107,111-112, 1976

Some routine flashpoint and flammability tests were run in conjunction with recent loss investigations, yielding some unexpected results. First, flash fires were obtained at ambient temperatures 70°F(39°C) below the flash point of the liquid. Second, in some bonding agent mixtures, flash points more than 30°F (17°C) below the flash point of any components in the mixture were obtained. The most common circumstance under which this type of fire is likely to occur will probably also produce serious or fatal injuries. The results have also indicated that the current 100°F (37.8°C) division point between flammable and combustible liquids is too low for all applications; users are not being provided with adequate warning on the hazards of combustible liquids, and some liquids should possibly be banned for domestic use. Flash point temperatures for the various liquids tested and other parameters are presented in table form. The fire which prompted the investigation is discussed and analyzed. 7 tables. (Author)

32. Abduragimov I and Krylov E
DEVELOPMENT AND EXTINGUISHMENT OF FIRES IN MECHANIZED HIGH-RACK WAREHOUSES
Pozhar_delo, (10):24-25, 1975 (Russian)

33. Jach W
FIRE DISASTERS IN UNFINISHED BUILDINGS - INTRODUCTION TO A NEW RISK COMPLEX
VFDB_Z, 24(3):113-117, 1975 (German)

An ever increasing number of major fires in unfinished buildings has been noted in the past few years, especially in tall and very tall buildings. The fire causes are arson and negligence. The combustible materials involved are mainly packing and insulation materials, often with very high heat values. The results are not only heavy fire damage, but also formation of soot deposits and the liberation of corrosive fire gases. Fires in three highrise buildings are described in detail. The author concludes that such fires can be avoided only if preventive measures are developed and applied with sufficient energy. 7 refs. (Author)

34. Bromme H
ANALYSIS OF VEHICLE FIRES
Polizei Tech Verkehr, 20(9):86-87, 1975
(German)

Data are presented on the distribution of fires in 15 different makes of cars from a sampling of 1000 fire incidents, 117 of which broke out as a result of highway accidents and 883 without accidents. The data are summarized in a table showing the percentage of the 15 makes of vehicles (plus a miscellaneous entry) in the total number of cases and the number of fires for these makes with and without accidents. 1 table.

35. Plonus MA
IGNITABILITY OF ANECHOIC CHAMBER FOAM BY ELECTRIC CURRENTS
IEEE Proc, 63(10):1371, 1975

Anechoic chamber foams are easily ignited by passage of current through them. Two distinct ignition processes can be observed. The first is a contact fire that results when two sharp points which are of a potential difference of more than 100 V touch the conducting foam. The second is an I^2R heating of the interior of the foam which begins with smoldering, then a glowing chunk of foam inside the material which grows and usually ignites. An unexpected by-product of the burning carbon-impregnated foam is the voluminous release of intense toxic smoke. 1 ref. (Author)

36. Anon
AEC URANIUM FIRE EXPERIENCE. Battelle Pacific Northwest Labs; HAN 64841, 27 pages, Sep 1975
Availability: NTIS

An inquiry was made to all Operations Offices soliciting literature references on any research on U fires, case histories of any fires involving massive U, and suggestions for research on U fire properties. Replies, a field trip to AEC contractor sites, and a review of individual fire reports form the basis of this report. Five basic types of U fires are distinguished. Water and H(2) were found to increase the pyrophoricity of U. Recommendations are given for a research program.

37. Lucha GV, Robertson MA and Schooley FA
AN ANALYSIS OF AIRCRAFT ACCIDENTS INVOLVING FIRES. TECHNICAL REPORT, 22 OCT 1974-22 May 1975. Stanford Res Inst; NASA CR-137690, 148 pages, May 1975
Availability: NTIS

All U.S. Air Carrier accidents between 1963 and 1974 were studied to assess the extent of total personnel and aircraft damage which occurred in accidents and in accidents involving fire. Published accident reports and NTSB investigators' factual backup files were the primary sources of data. Although it was frequently not possible to assess the relative extent of fire-caused damage versus impact damage using the available data, the study established upper and lower bounds for deaths and damage due specifically to fire. In 12 years there were 122 accidents which involved airframe fires. Eighty-seven percent of the fires occurred after impact, and fuel leakage from ruptured tanks or severed lines was the most frequently cited cause. A cost analysis was performed for 300 serious accidents, including 92 serious accidents which involved fire. Personal injury costs were outside the scope of the cost analysis, but data on personnel injury judgements as well as settlements received from the CAB are included for reference. (Author)

38. Anon
SPECIAL INVESTIGATION: UMTA PROTOTYPE BUS FIRE NEAR PHOENIX, ARIZONA, MAY 13, 1975. Nat Transp Safety Board, Bureau of Surface Transp Safety, Washington, DC; NTSB HAR-75-8, 33 pages, Dec 1975
Availability: NTIS PB-248 776/7GA

The report presents the Board's investigation of an accident involving a bus which caught on fire in the upper right area of the engine compartment. The driver tried to extinguish the fire through the hood access door, but it did not provide adequate access to extinguish the fire. The fire spread to the passenger compartment and destroyed the entire bus. The National Transportation Safety Board determines that the probable cause of the fire was the ignition of oil which leaked from the accessory drive manifold and it came in contact with a hot engine exhaust system component. The fire spread because of 1) the failure of the hood-opening mechanism to operate and permit fire extinguisher access, and 2) the presence of fire-consumable materials in the fire wall of the bus. (Author)

39. Moore LD and Vickers AK
A SURVEY OF FIRE ACCIDENTS INVOLVING CURTAINS AND DRAPERIES - DEATHS, INJURIES AND FINANCIAL LOSS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-902, 35 pages, Dec 1975
Availability: NTIS PB-249 539/8GA

A case history of 286 fire accidents was conducted. This survey was composed of three groups of case histories in which curtains or draperies were involved. The cases were analyzed in detail, attempting to ascertain the extent to which these products represented fire hazards. (Author)

40. Anon
SS C.V. SEA WITCH - SS ESSO BRUSSELS (BELGIUM); COLLISION AND FIRE IN NEW YORK HARBOR ON 2 JUNE 1973 WITH LOSS OF LIFE. Coast Guard, Washington, DC; USCG NTSB-MAR-75-6, 74 pages, Dec 1975
Availability: NTIS AD-A021 429/6GA

On 2 June 1973, the SS C.V. SEA WITCH lost steering control in New York harbor. The ship moved out of the channel and struck and penetrated the anchored Belgian tankship SS ESSO BRUSSELS which was loaded with crude oil. The 31,000 barrels of oil from three ruptured tanks ignited and the resulting fire engulfed both ships. The master and two crewmembers died aboard the SEA WITCH. The master and ten crewmembers of the ESSO BRUSSELS died after abandoning ship, one crewmember died aboard ship, and one crewmember is missing. Some nearby beaches were polluted, and damage to the ships and cargo amounted to about 23 million dollars. The National Transportation Safety Board determined that the probable cause was a mechanical failure in the steering system of the SEA WITCH and the lack of adequate and timely action by the crew to control their ship after the failure occurred. The cause of the loss of steering was the deficient design of the system which did not provide "two separate and independent steering control systems" as required by 46 CFR 58.25. The cause of the fire, pollution, and deaths after the collision was that the typically designed bow of the SEA WITCH penetrated the hull of the ESSO BRUSSELS instead of absorbing the crash energy. (Author)

41. Mainstone RJ
THE RESPONSE OF BUILDINGS TO ACCIDENTAL EXPLOSIONS. Building Res Estab (UK), Fire Res Sta; BRE CP-24/76, 11 pages, 12 figs, 7 refs, Mar 1976

Nine instances of major accidental explosions are described. In each case something is said about the probable loading, and the major features of the structural response are then described. As background there are introductory sections on the character of explosions loadings and the type of response to be expected theoretically. The paper concludes with a listing of six generally valid lessons drawn from inspections of the actual responses. (Author)

42. Silcock A and Tucker DM
FIRES IN SCHOOLS: AN INVESTIGATION OF ACTUAL FIRE DEVELOPMENT AND BUILDING PERFORMANCE. Building Res Estab (UK), Fire Res Sta; BRE CP-4/76, 76 pages, 59 figs, 4 tables, 8 refs, Jan 1976

The number of fires in schools is increasing, owing mainly to malicious ignition, and the high cost of reinstatement requires consideration of measures to reduce the extent of damage. The Field Investigations Section of the Fire Research Station has carried out detailed investigations of a number of school fires in cooperation with the Department of Education and Science to assess the performance of school buildings under fire conditions. The immediate aim was to make proposals for possible revisions of structural fire requirements and to point the way to further improvements.

The report gives a detailed study of 14 of the incidents investigated. The functions of various elements of a building in a fire are explained and assessments of actual performance in the particular fires are given.

The major single factor affecting fire-spread was the presence of undivided ceiling voids, but other means of spread were also important. The extent of spread and consequent fire damage was considerably influenced by the construction and the nature of materials used.

The results of the investigation indicate that those who design, build, staff and maintain buildings do not appreciate fully the fire hazards involved in the use of non-traditional construction and materials. Suggestions are put forward for earlier discovery by automatic and human detection, and for the limitation of damage by smoke and fire. The latter involves considerations of general planning and site layout, subdivision of ceiling voids, fire venting through roofs and windows, the fire resistance of doors and partitions, fire-spread through vertical cavities and ducts, and maintenance. (Author)

43. Koplon NA
A REVIEW OF THE BAPTIST TOWERS FIRE, ATLANTA, GEORGIA
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 4-8
Sponsor: Armstrong Cork Co

A brief review is given of a tragic fire that occurred on Nov 20, 1972, in an eleven-story fire-resistive building. The final results and conclusions exemplify that once a fire ignites beyond its origin of compartmentation, occupants throughout the building are plagued by smoke, heat and other combustion products. The results of the fire analysis and critique were a modification of the Atlanta Building Code. (Author)

44. Ifshin S
REPORT ON SOME HIGH-RISE BUILDING FIRES WHICH OCCURRED IN NEW YORK CITY IN THE LAST FEW YEARS
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 1-4
Sponsor: Armstrong Cork Co

Several widely publicized fires in modern highrise office buildings in New York City in 1970 highlighted the multiple fire-death potential and raised public concern about the safety of those who work in such buildings. The fires are discussed and analyzed. (Author)

45. Parrott BF
A FATAL MOBILE-HOME FIRE - 8 VICTIMS
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 14-19
Sponsor: Armstrong Cork Co

Factors relating to the cause, fire spread, a description of the construction and finishes of the mobile home, and obvious suspicious conditions which led to the realization that meaningful fire safety standards should be implemented are discussed. The information presented is based upon the Michigan-required report of fatal fires. Numerous agencies participated in the investigation and the case remains under investigation. (Author)

46. Maxwell MH
INTERESTING HIGH-RISE BUILDING FIRES IN AMERICA'S MOST INTERESTING NEW ORLEANS
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 9-14
Sponsor: Armstrong Cork Co

Several highrise fires in hotels, motels, an office/apartment, and a brewery are reviewed. The seriousness of smoke generation, elevator evacuation, stairwells, and other salient building features are discussed. (Author)

47. Willey AE
RECENT FIRES OF IMPORTANCE TO THE RESEARCHER
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 39-45
Sponsor: Armstrong Cork Co

The NFPA Analysis Department each year conducts investigations of fires which are of interest to those involved in research. Recent significant fires are cited as examples of what to expect from the full-scale fire situation. Performance of building assemblies, materials, and life-safety systems in these fires is related to fire-test data and code requirements. (Author)

48. Taylor AF
FIRE, FUEL AND SURVIVAL: A STUDY OF TRANSPORT AIRCRAFT INCIDENTS, 1955-1974;
Paper No. 26, 5 tables
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

Accident summaries and reports are examined together with existing papers on the various aspects of fire safety, the aim being to piece together a complete picture of the part fire has had in determining overall fatality rates in transport aircraft accidents. Note is taken of the sensitivity of the fire death ratio to the number of high impact accidents with no chance of survival and of how this sensitivity may have clouded some past comparisons between fuels of different volatility. It is indicated that in most impact fires the higher volatility fuels, gasoline and wide-cut gasoline, have been responsible for proportionately more fire deaths than has low volatility kerosine, thus confirming predictions based on theory and experiment. 14 pages, 9 figs, 5 tables. (Author)

49. Schurter W
PASSENGER AIRCRAFT CABIN FIRES; Paper No. 27
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

After a brief review of the established findings on the crash of a Swissair Coronado CV-990A in Wurenlingen, Switzerland, on February 21, 1970, an analysis of the cabin fire preceding the crash is given, including origin of fire, its propagation and effects on the aircraft systems. A method of establishment of elevated local temperatures in cargo compartment and cabin by means of uncommon fractures as found in the wreckage is described. The role played by the major aircraft systems is discussed. Furthermore, since the smoke spreading in cabin and cockpit is considered the factor rendering the aircraft uncontrollable under the prevailing conditions, the results of tests carried out simulating the smoke conditions are given. 5 pages. (Author)

50. Guillevic P
THE PP-VJZ AIRCRAFT CRASH; Paper No. 28
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy (French)
Sponsor: AGARD

The results of investigations that followed the crashes of two aircraft (a Caravelle in 1968 and a Boeing 707 in 1973) following fires that started in rear washrooms were reported. In both cases, it was concluded that fatalities were primarily caused by intoxication resulting from the inhalation of carbon monoxide and highly acidic toxic vapors such as hydrochloric acid and hydrocyanic acid originating in the combustion of cabin finishing materials. 6 pages, 1 fig. (Author)

e. FIRE SCIENCE EDUCATION

f. LEGISLATION

51. Jansky D
DETECTOR LAW CAN AFFECT OLD HOMES
Fire Eng, 129(5):31, 1976

Farmers Branch, Texas, a Dallas suburb, has passed a smoke detector ordinance that is retroactive under certain circumstances. It requires the installation of smoke detectors not only in all new residential occupancies, but also in existing homes upon a change of occupancy or ownership, or after repairs or additions exceeding $500 in value. Provisions of the ordinance are presented. 2 photos.

52. Roach AP
FORMULATION OF POLICY WITH RESPECT TO FIRE REGULATIONS
Fire Prev, (113):33-34,36-37, 1976

The development of fire protection regulations to form the basis for approval at the building stage and to form the standard for other forms of approval or certification under the "Health and Safety at Work etc. Act" (UK) is discussed. The objectives and ways in which they may be developed are explained.

g. RESEARCH AND DEVELOPMENT PROGRAMS

53. Bricker RW and Stuckey RN
FIRE RESISTANT AIRCRAFT MATERIALS DEVELOPMENT AND EVALUATION PROGRAM; Paper No. 70
Space Simulation Conf, 8th; 1975, Lyndon B Johnson Space Center, Houston, TX, pages 833-854

An aircraft flammability program was undertaken to utilize spacecraft developed fire-resistant materials to improve passenger safety and decrease losses from unattended fires in commercial aircraft. Five full-scale aircraft flammability tests were performed to evaluate the effectiveness of improved fire-resistant materials by comparing their burning characteristics with those of pre-1968 aircraft materials. (Author's Abstract)

54. Degrave A and Van Acker A
BELGIAN RESEARCH CONCERNING FIRE PROTECTION. REAL FIRE TEST ON AN INDUSTRIAL BUILDING
Precast Concrete Industry Congress, BIBM, Internat, 8th, Proc; 1975, May 12-19, Stresa, Italy
Sponsor: Cement and Concrete Assn, London

Owing to the lack of scientific and technical information on fire protection in the construction field, the Nat Fire Res Council was established in Belgium, consisting of specialists in fire prevention, protection and fighting, testing, and others involved in fire safety problems in buildings. The research program is concentrated on all scientific and technical aspects of fires and buildings. Research topics and studies are identified. A real fire test on an industrial building is described and tentative conclusions are drawn. 17 pages. (Author)

55. Lyons D
DEVELOPMENT OF NEW TECHNIQUES IN THE TOKYO FIRE LABORATORY
Fire, 68(842):135-6, 1975

General information is given on some developments at the Fire Science Lab in Tokyo. Techniques are described for solidifying dangerous liquids and clearing smoke with electrostatic filters. The development of an escape chute is discussed, as well as a bucket from which liquid extinguishants can be tossed on a fire a splash at a time.

56. Anon
SUPERVISORY SCHEME FOR FIRE TEST LABORATORIES
Fire, 68(849):516-517, 1976

This scheme will be concerned with the competence of certifying laboratories to carry out fire tests specified in UK building regulations and certain other related tests. A certificate will be issued to those laboratories satisfying the requirements of the Dept of the Environment. Laboratories wishing to be certified will have to apply to the department, which will inspect the laboratories' facilities. After the first certificate has been issued, periodic inspections and spot checks will be carried out, and provision will be made for withdrawal of a certificate. The scheme will be self-financing, as the cost of the inspection and certification will be charged to the laboratories.

57. Harrison GA and Houser JL
A SURVEY FOR THE COLLECTION OF PROFESSIONAL OPINION ON SELECTED FIRE PROTECTION ENGINEERING TOPICS. Nat Bureau of Standards; NBS TN-861, 30 pages, Mar 1975
Availability: GPO SD Catalog No. C13.46: 861

A questionnaire survey on selected fire protection engineering topics was sent to 422 persons from every state and major city in the United States and, also, parts of Canada. The survey included architects, engineers, insurance and government representatives, academics, and fire service personnel. One hundred and eighty-six questionnaires were returned, a 46.2 percent return rate. This return rate is more than double the Nat average on survey returns. The questionnaire covered topics such as the adequacy of the term "non-combustible" as contained in the Nat Fire Protection Association's Nat Fire Code, hazards of fire loading concepts, code regulation and enforcement, furnishings, sprinkler systems and smoke detectors. In addition to the questionnaire data, many of the surveyed took the time to write in various unsolicited comments.

Although this survey does not represent a statistical study approach, it is the best effort to date to gather and document the current professional thinking on fire protection matters. When the data permitted, obvious and significant group thought ideas and patterns are documented. The objective of this survey is to collect and document professional opinions on selected fire protection engineering topics for the purpose of determining current professional thinking, and indications of future trends of thought.

58. McCabe R, Culver CG, Lee L and Hirschberg J
DATA PROCESSING AND DATA ANALYSIS PROCEDURES FOR FIRE LOAD AND LIVE LOAD SURVEY PROGRAM. Nat Bureau of Standards, Inst Appl Technol; NBSIR 76-982, 344 pages, Jan 1976
Availability: NTIS PB-248 699/1GA

Data collection and data processing

procedures utilized in connection with a nationwide fire load and live load survey program are described. The techniques developed for transferring the field survey data to a form suitable for computer processing are discussed. Procedures adopted for data analysis are included. Documentation of the computer programs developed for this purpose is also presented. (Author)

59. Clarke FB and Raisher DW
ATTACKING THE FIRE PROBLEM: A PLAN FOR ACTION, 1976 EDITION. Nat Bureau of Standards, Center for Fire Res; NBS SP-416-76, 46 pages, Jan 1976
Availability: NTIS PB-249 540/6GA

The mission of the Center for Fire Research is to insure the development of the technical base for the standards and specifications needed in support of the National goal to reduce fire losses by 50% over the next generation. A systems approach to accomplish this mission is described. The Center consists of four basic programs in the area of Fire Science and five applied research programs in the area of Fire Safety Engineering. Each applied program addresses an aspect of the Fire Problem, using fundamental information supplied by the basic research function. Active participation by staff members in voluntary standards organizations is the principal means of making this technology available for codes and standards needed to reduce the Nation's fire loss. (Author)

60. Lyons JW
FIRE RESEARCH AND FIRE SAFETY - A STATUS REPORT ON THE SITUATION IN THE UNITED STATES; Paper No. 1
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

During the past century efforts to control and reduce fire losses have concentrated successively on conflagrations destroying entire cities or large sections of them, on fires destroying large buildings, and, finally, on fires in the room of origin or in family residences. The first effort created effective fire departments, the second, the fire endurance concepts now an important part of the Nation's building codes, and the third, now in full development, has produced research programs on interior finish, furnishings, and other consumer products. This current effort to protect occupants in the room of fire origin or in family residences is proving to be the most challenging and complex, technically and socially, of the three. These occupancies vary in materials used, configuration of the rooms, and placement of an infinite variety of movable contents.

To assess the level of fire safety we must be able to compute or measure the time-temperature and time-gas concentration profiles at a number of points in the room. This requires, first, careful full-scale research and concomitant theoretical modeling. Second, it requires smaller, more economical tests which are correlated with the full-scale work. A series of such smaller tests will be necessary, including smoke and gas evolution, rate of heat release, and rate of fire spread over surfaces. Work on all of these is active now in many laboratories. The symposium will provide interesting progress reports on some aspects of these current efforts. (Author's Abstract)

2. DYNAMICS AND MECHANICS OF FIRE

a. FIRE BUILDUP, PROPAGATION, AND SPREAD

61. Werthenbach HG
SIGNAL FLOW CHART OF A TANK FIRE - RELATIONSHIP BETWEEN THE MOST IMPORTANT PARAMETERS. I.
VFDB Z, 25(2):62-63, 1976 (German)

This signal flow chart, which represents the chain of events in tank fires, is based on, among other things, a heat transport model for liquids without the formation of heat zones. For this reason, the suppositions are tank diameters of 1 to 2 m and strongly luminescent flames. 4 figs. (Author)

62. Waide DC
AN IMPROVED RECIPE FOR BACKDRAFT
Fire Chief, 20(6):42-43, 1976

New energy-saving features in homes to prevent heat or cooling loss, such as insulation and thermo-pane windows, permit structures to create a rapid heat and smoke build-up in case of fire, resulting in a common firefighter killer, smoke explosion or backdraft. The author describes some of these features to alert the firefighter to detect backdraft conditions.

63. Kiselev VF and Sidoryuk VM
FLAME SPREAD THROUGH SHIP CORRIDORS
Sb Tr VNII protivopozhar oborony, (5):16-27, 1974 (Russian)

Experimental results from the study of the density of the heat fluxes acting on finishing materials in ship corridors in the fire buildup stage are examined. The critical values, nature and conditions of flame spread, including the influence of the combustibility of the materials on flame spread over a surface, are established. (Author)

64. Sirignano WA
FLAME SPREADING ACROSS MATERIALS: A REVIEW OF FUNDAMENTAL PROCESSES; Paper No. 15
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

A critical review of the existing researches on flame spread above solid combustible materials is given; both theory and experiment are considered. Special attention is given to the determination of the rate-controlling mechanism for energy transfer ahead of the flame and therefore to the determination of the flame spreading rate. The mechanism could be either gas-phase conduction, radiation, gas-phase convection, or some combination of these. Important factors discussed include: natural convective flows, orientation of the direction of flame spread with respect to gravity, thickness of the burning material, and the values of the conductivity, diffusivities, heats of reaction and pyrolysis, chemical kinetic constants, and ambient oxygen concentration. It is indicated how changes in these factors can produce changes in the rate-controlling mechanism. 12 pages, 11 figs, 2 tables, 12 refs. (Author)

65. Babrauskas V and Williamson RB
POST-FLASHOVER COMPARTMENT FIRES. Univ of California (Berkeley), Fire Res Group; UCB FRG 75-1, 87 pages, 27 figs, 66 refs, Dec 1975

The requirements for fire resistance in buildings are examined. An historical background is given for the current building code requirements governing fire endurance tests. Relevant aspects of compartment combustion theory are set forth. Salient shortcomings, mainly in the area of fuel pyrolysis rates, are pointed out. Use of rationally calculated time-temperature curves for design and analysis is illustrated and discussed. A new design methodology is outlined which allows conservative, rationally based simplifications to be made. This approach, termed "pessimization," allows gas time-temperature curves to be produced that are applicable to a multiplicity of design conditions by letting certain variables always assume those values which would produce the highest temperatures. Finally, improvements offered by such a method over existing code design provisions are noted. (Author's Abstract)

66. Babrauskas V
COMPF: A PROGRAM FOR CALCULATING POST-FLASHOVER TEMPERATURES. Univ of California (Berkeley), Fire Res Group; UCB FRG 75-2, 51 pages, 5 refs, Jan 1975
Availability: NTIS PB-242 346/AS

COMPF is a computer program for calculating gas temperatures in a compartment during the post-flashover period of a fire. It is intended both for performing design calculations and for facilitating further research in endurance requirements for fire-resistive building assemblies. In addition to the capability of performing calculations for a compartment with completely determined properties, routines are included for calculating the fire behavior under certain worst expected conditions. A comprehensive output format is provided which gives gas temperatures, heat flow terms, and properties of the fire gases. The report includes input instructions, sample problems, and a listing of the program.

2. DYNAMICS AND MECHANICS OF FIRE
a. Fire Buildup, Propagation, and Spread

67. Heselden AJM and Melinek SJ
THE EARLY STAGES OF FIRE GROWTH IN A COMPARTMENT. A COOPERATIVE RESEARCH PROGRAMME OF THE CONSEIL INTERNATIONAL DU BATIMENT (Commission W14). Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1029, 41 pages, 9 figs, 7 tables

This note analyzes the data from laboratories taking part in an international cooperative research program studying the early stages of fire spread in a compartment, particularly the effects of 8 factors, comprising parameters of the compartment, fuel and ignition. All factors except the shape of compartment are statistically significant.

The contribution of wall linings is greatest when ignition is in a corner and the ventilation opening large. (Author's Abstract)

68. Fang JB
FIRE BUILDUP IN A ROOM AND THE ROLE OF INTERIOR FINISH MATERIALS. Nat Bureau of Standards; NBS TN-879, 49 pages, Jun 1975
Availability: GPO SD Catalog No. C13.46: 879

A variety of wall and ceiling panels in a full-scale room corner have been exposed to a fire from a standardized wood crib, simulating the environment produced by the burning of a single item of furniture, to evaluate their contribution to room fire growth. A total of twenty room corner tests were performed using selected combinations of eight wood-base and gypsum board-base interior finish materials on the walls and ceiling. Gas temperatures and velocities, surface temperatures, heat fluxes, smoke densities, and concentrations of oxygen, carbon dioxide and carbon monoxide were measured. Ignition times of newsprint, cotton fabric and plywood in the lower part of the room were also recorded. The results of these full-scale tests were compared with laboratory tests of the ease of ignition, surface flame spread, heat release rate and smoke generation on the same materials. The maximum upper room gas temperature has been found to agree with the ignition of such indicators as newsprint and plywood, and to represent a measure of fire hazard in terms of potential involvement of all combustible contents or room flashover. A temperature range of 450 to 650°C appears to be the boundary between limited and full involvement.

69. Quintiere JG
A CHARACTERIZATION AND ANALYSIS OF NBS CORRIDOR FIRE EXPERIMENTS IN ORDER TO EVALUATE THE BEHAVIOR AND PERFORMANCE OF FLOOR COVERING MATERIALS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-691, 89 pages, Jun 1975
Availability: NTIS COM 75-11015

Data is presented for four fire experiments which examine the fire propagation from a room fire to a floor covering material in a corridor. The four floor covering materials include a nylon and an olefin carpet, vinyl sheet, and red oak flooring. Limited flame spread occurred for the vinyl sheet material: however, the three other materials involved full fire propagation in the corridor. The data are analyzed to examine the factors influencing fire propagation. Included in this analysis is the rate of energy contribution from the room fire and floor covering material, the rate of flame spread, heat transfer to the floor covering, and flow interactions between the room and corridor. A review of previous related experiments is also presented.

70. Zukoski EE
CONVECTIVE FLOWS ASSOCIATED WITH ROOM FIRES. California Inst of Technol, 57 pages, 18 figs, Jun 1975

Turbulent and buoyant convection currents play an important part in fire development within a single compartment and in fire spread through a multi-compartmented structure. The aim of the present program is to investigate the fluid dynamic aspects of these flows through use of small-scale modeling experiments.

Fluid dynamic aspects of an isolated room fire which we are investigating experimentally include the turbulent plume rising from the fire, the ceiling layer formed by impingement of the plume on the ceiling, the flow processes at the door or window, and the flow of hot gas outside the door or window. Particular emphasis will be placed on the study of entrainment and mixing processes.

The experimental approach taken in this project has been to use salt water to model the hot combustion products and fresh water the unheated air. Geometrically similar and small-scale (1/10 to 1/4 scale) room models are used, and the flow field is inverted to account for the sign of the density differences. Various techniques (optical, conductivity probes, hydrogen bubble, etc) are used to determine density and velocity fields of interest.

Simple analytic models are being developed to allow the results to be scaled to full-size flows and to predict the effects of important parameters on density and flow fields in a room fire in its early stages of development.

Although these experiments have been carried out with water-salt water fluids in inverted models, the discussion given below will be in terms of the real situation for the sake of simplicity in this abbreviated account. That is, the floor will be at the bottom of the picture, whereas in the tests it is at the top. The heavier salt water flow, introduced at the top of the model to form a downward flowing buoyancy plume, is used to model the normal fire plume. (Author's Abstract)

71. Fernandez-Pello A and Williams FA
LAMINAR FLAME SPREAD OVER PMMA SURFACES
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 217-231
Sponsor: The Combustion Inst

A study is made of the mechanisms by which laminar flames spread over flat surfaces of polymethylmethacrylate, in directions ranging from downward to horizontal. Measurements of spread rates, temperature fields and velocity fields are reported. Techniques employed include thermocouple probing, photography, interferometry, radiometer measurements, sampling followed by gas chromatography, and particle-track photography. A simplified theoretical model of the spread process is developed, involving forward heat conduction through the solid as the major mode of the energy transfer and thermal runaway of a gas-phase ignition reaction of methylmethacrylate vapor in a boundary layer just upstream from the point of flame attachment. The extent to which this physical model applies to other materials will depend on the thermal and chemical-kinetic properties of those materials. 12 figs, 24 refs (Author's Abstract)

72. Orloff L, DeRis J and Markstein GH
UPWARD TURBULENT FIRE SPREAD AND BURNING OF FUEL SURFACE
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 183-192
Sponsor: The Combustion Inst

Two-dimensional upward flame spread and subsequent steady turbulent burning of a thermally thick vertical fuel surface is examined theoretically and experimentally. The upward spread rate for vertical PMM slabs is observed to increase exponentially with time. This result is predicted in terms of measured fuel thermophysical properties, flame heights and heat feedback to the fuel surface. The local steady burning rates established after completion of upward spread exhibit a minimum at a height of 18 cm from the bottom edge and increase continuously beyond this height, becoming 70 percent larger at a height of 140 cm. This increase is shown to be entirely attributable to increasing flame radiation.

Individual measurements of the various energy transfer components during steady burning of the PMM slabs are obtained from radiant intensity measurements of 1) the surface alone and 2) flame plus surface. Above 76 cm flame radiation ranges from 75 to 80 percent of the total (radiation plus convection) heat transfer from the flames to the fuel surface. Surface heat transfer by convection decreases slightly with height. 6 figs, 1 table, 14 refs (Author's Abstract)

73. Quintiere JG
SOME OBSERVATIONS ON BUILDING CORRIDOR FIRES
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 763-774
Sponsor: The Combustion Inst

Full-scale corridor fire experiments designed to evaluate the potential fire hazard of floor covering materials exposed to a room fire are described. A phenomenological account of events leading to rapid fire propagation along the corridor is presented for one experiment. Mechanisms responsible for the rapid fire propagation, termed flameover, are explored through measurements and analysis of the data. Before flameover the corridor floor is heated by radiation which enables flames to spread into the corridor. On the wood floor considered, flame spread velocity accelerates from approximately 10^{-2} ft/sec to approximately 1 ft/sec following flameover. Causative factors of flameover appear to be the increase in flame height to the floor fire, and a reduction of air supply to the burn room due to a change in flow pattern between the corridor and burn room. Calculations show that air flow to the burn room steadily drops as the corridor fire develops resulting in incomplete combustion for the room fire. 10 figs, 1 table, 15 refs

74. Thomas PH
SOME PROBLEM ASPECTS OF FULLY DEVELOPED ROOM FIRES; Paper No. 6
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

A number of diverse aspects of compartment fires have been briefly examined and attention is drawn to certain secondary features of these fires which lie outside what is acceptable as a theory of the design prediction of fire resistance. One can describe one feature of flashover - perhaps only certain kinds of flashover - as a transition across a fuel-controlled regime which is unstable in conditions of uniform burning. The descriptions employed here are highly over-simplified and the conclusions somewhat speculative, but future studies on these lines might be rewarding. A calculation of a critical parameter gives a value of similar order to that observed by Tewarson and suggests an important role for wall heat loss. Certainly once one departs from the design of fire resistance, the theory of fully developed fires requires considerable development to provide an adequate base for the other fire problems, be they in design, fire stability and control or the role of extended flammable surfaces in producing fuel which burns outside the window. (Author's Abstract)

75. Quintiere JG
GROWTH OF FIRE IN BUILDING COMPARTMENTS; Paper No. 7
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

A review is presented of both full-scale and model experiments concerned with fire growth and spread in building compartments. It appears that "flashover," i.e. the rapid transition to a fully-developed room fire, could be initiated by a fully involved chair fire alone, or by a large waste container ignition source against a combustible wall lining material. Scale model results continue to provide valuable insight, but the validity of partial scaling results must be considered for each type of experiment. A quasi-steady idealized mathematical model has been developed to analyze the various parameters of fire development in a room. These theoretical results show the significance of fuel properties, fire size and location, room and doorway dimensions, and wall thermal properties. The limitations of a mathematical approach are also discussed. (Author's Abstract)

76. Gross D
THE MEASUREMENT AND CORRELATION OF FIRE GROWTH IN A ROOM
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 77-87
Sponsor: Armstrong Cork Co

Evaluation of fire growth in a room requires characterization of the source fire, defining a measure of full-fire involvement, and correlation in terms of small-scale laboratory tests. A series of 20 room-corner tests was performed using a wood-crib ignition source and selected combinations of interior finish materials on wall and ceiling surfaces. The upper room-gas temperature was taken as a measure of fire-growth level and potential involvement of all combustible contents. Comparisons are presented between results of the full-scale tests and available laboratory tests on the interior finish materials. Supplementary approaches involving analytical and reduced-scale modeling are also discussed. 8 figs, 2 refs. (Author)

b. FLAMMABILITY, IGNITION, AND EXTINCTION

77. Martin JR and Miller B
THE FLAMMABILITY BEHAVIOR OF MIXTURES CONTAINING WOOL AND SYNTHETIC FIBERS
Wool Textile Research Conf, 5th Internat, Proc; 1975, Sep 6, Aachen, Germany
Sponsor: Internat Wool Secretariat

The flammability behavior of a series of polyester-wool and nylon-wool fabrics has been investigated in terms of a number of flaming combustion and thermal decomposition characteristics. Combustion behavior has been characterized by burning rate and extinguishability measurements; decomposition behavior by dynamic thermogravimetry and analysis of volatile decomposition products. These fiber blends show complex burning behavior which cannot be predicted from the behavior of the components alone. Evidence for chemical interaction is presented, based on decomposition data. 8 figs, 3 refs (Author's Abstract)

78. Hilado CJ
A METHOD FOR ESTIMATING LIMITS OF FLAMMABILITY
J Fire Flammability, 6(2):130-9, 1975

Pointing out that many compounds are too reactive, too toxic or too high-boiling to be tested in available apparatus, the author considers the need for a satisfactory method of assessing the flammable limits of such compounds. Listing the existing methods he then proposes a straight empirical approach using the available data bank on flammable limits and looking for a relationship similar to that found by the US Bureau of Mines. Results indicate that the lower and upper flammable limits in air of organic compounds can be estimated as functions of the stoichiometric composition for combustion in air. 2 tables, 3 refs. [Safety in Mines Abstracts]

79. Shurygin AP, Chernenko NA and Bernadiner MN
EVALUATION OF THE FLAMMABILITY OF LIQUID INDUSTRIAL WASTES
Khim prom, (8):28-31, 1975 (Russian)

The error of using the heat of combustion of liquid industrial wastes as an indicator of their flammability is demonstrated. The most complete characteristics of the flammability of liquid wastes are the calorimetric and minimum required operating temperatures of the combustion process. These two indicators of flammability are determined for certain types of liquid wastes.

80. John R
FIRE BEHAVIOR OF ELECTRICAL CABLES IN FALSE CEILINGS AND FLOORS
VFDB Z, 25(2):41-50, 1976 (German)

A study is made of the fire behavior of cables in false ceilings and floors. Tests were made of single cables and clusters of cables (24 strands) in a 2-m duct terminating in a smoke-removal vent at various ambient temperatures. Observed were the effects of application of flame to electrically loaded and unloaded cables and of short-circuiting of loaded cables. From the results a critical cable insulation temperature at which ignition by short circuit or external source at one point spreads over the entire cable length is derived (190°C). Cable systems that conform to the regulations do not heat up to such an extent that ignition spreads appreciably from the point of ignition. 11 figs, 2 tables.

81. Block I
FABRIC IGNITABILITY AND THE MEASUREMENT OF FLAMMABILITY BEHAVIOR
J Consumer Prod Flammability, 3(1):62-8, 1976

The char length of restrained and semi-restrained samples of a variety of apparel fabrics was measured after ignition by paper tabs sewn to the bottom edge of the sample. The char length was found to be dependent upon the heat output of the paper tab, the fiber type, and, for thermoplastic materials, the sample shape. The procedure may be suited to measuring the ease of ignition of apparel fabrics. (Author's Abstract)

82. Arya PK and Bajpayee TS
INVESTIGATIONS ON INFLAMMABILITIES OF COAL DUST
J Mines Met Fuels, 23(3):135-7, 1975

A method for measuring the ignition temperature and relative flammability of coal dust is described. The Godbert's apparatus is used for measuring the above parameters. The inflammability is measured in the form of amount of stone dust required to quench the propagation of flame. 3 refs.

83. Damant GH
FLAMMABILITY ASPECTS OF UPHOLSTERED FURNITURE
J Consumer Prod Flammability, 3(1):21-61,

2. DYNAMICS AND MECHANICS OF FIRE
b. Flammability, Ignition, and Extinction

1976

Investigation of the flammability characteristics of upholstered furniture by the Flammability Research Laboratory of the California Bureau of Home Furnishings has included a number of studies and surveys of both composite and component furniture materials: 1) upholstery fabrics (59 materials); 2) supplementary tests of 95 additional upholstery fabrics; 3) flexible polyurethane foam (37 formulations); and 4) flexible polyurethane foams used in upholstery (40 formulations). This paper summarizes some of the work in furniture composites and will indicate the interactions of dissimilar upholstery materials when tested in the form of furniture cushions and prototype mock-ups. In addition, the positive flammability effect of using filling materials which comply with California furniture regulations versus conventional filling materials will be indicated. 5 figs, 18 refs.

84. Miller B and Martin JR
A METHODOLOGY FOR THE INTERPRETATION OF THE THERMAL AND FLAMMABILITY BEHAVIOR OF MULTICOMPONENT FIBROUS POLYMER SYSTEMS
J_Fire_Flammability, 6(2):105-18, 1975

The purpose of this paper is to introduce a systematic basis for evaluating the flammability behavior of multicomponent fibrous polymer materials. It is shown that various performance characteristics are involved, and no one evaluation technique can be depended upon to reveal interactive behavior. Criteria are presented for identifying noninteractive behavior for a number of flammability properties. On the basis of these criteria, systems are identified which show definite interaction during some phase of the burning process. 7 figs, 6 tables, 11 refs. (Author's Abstract)

85. Burgess D and Hertzberg M
THE FLAMMABILITY LIMITS OF LEAN FUEL-AIR MIXTURES: THERMOCHEMICAL AND KINETIC CRITERIA FOR EXPLOSION HAZARDS
ISA_Trans, 14(2):129-36, 1975

The present knowledge is reviewed concisely in terms of the experimental methods used, the effect of apparatus size, accuracy of data, methods of data presentation, and the sensitivity of the limits to initial temperature and pressure. 13 refs. (Author's Abstract)

86. Pinkel II
DYNAMIC EFFECTS IN THE SETTING OF AIRPLANE CRASH FIRES; Paper No. 25
Aircraft_Fire__Safety,__AGARD__Propulsion and_Energetics_Panel_Meeting,_45th,_Proc, Oct_1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The principal features of airplane crash dynamics are described. Factors considered include: fuel spillage; movement of spilled fuel to main ignition sources; propagation modes of fire to the main spillage and the fuel tank opening. Some of the main factors in the ignition and spread of fire are illustrated with slow motion pictures of full-scale airplane crashes. 4 pages. (Author)

87. Durbetaki P, Acree RL and Wulff W
IGNITION OF FABRIC ASSEMBLIES SUBJECT TO RADIATIVE HEATING; Paper No. 6, Session No. IV
Flammability_and__Burning_Characteristics of_Materials__and__Fuels_Meeting,_Combustion__Inst,__Joint__Central__and__Western States_Sections,_Spring; 1975, Apr 21-22, San Antonio, Texas
Sponsor: The Combustion Inst

The garment burn injury hazard is quantitatively related to fabric ignition time. The reliable prediction of ignition time in terms of material properties and exposure conditions is therefore essential for the general assessment of fire hazard. One problem associated with the fire hazard of fabrics is the ignition of multilayer assemblies. This paper describes the effect of interaction between parallel layers of fabrics on the ignition time, when the assembly is subjected to radiative heating. A lumpedparameter model has been formulated to simulate the thermal response to radiative heating and predict the ignition time of an assembly of two fabric layers separated by a specified air gap. Fabric ignition times have also been measured by exposing similar and dissimilar fabric pairs to a time invariant radiative source. The measurements investigated the effect of inter-layer spacing and heating intensity on the ignition times. These measurements are compared with the predicted ignition times from the analysis and with ignition time measurements on single layer fabrics performed in the same test facility. In the absence of reliable information on kinetic parameters for pyrolyzing fabrics, the predicted fabric ignition times have been found to show the proper trend with the measured ignition times. 29 pages, 11 figs, 3 tables, 11 refs (Author's Abstract)

88. Macek A
FLAMMABILITY LIMITS: THERMODYNAMICS AND KINETICS. Nat Bureau of Standards, Center for Fire Res; NBSIR 76-1076, 22 pages, 4 figs, 2 tables, 19 refs, May 1976
Availability: NTIS

Extinction limits for both premixed and diffusion flames for n-alkanes and n-alcohols found in the literature are assembled. Several sets of theoretical flame temperatures corresponding to the limits are defined and presented. The implications of the view that flames fail to propagate at temperatures at which reaction rates become too low to overcome the dissipation processes are discussed. Equilibrium flame temperatures indicate that at lean limits the excess oxygen does not act merely as a diluent but takes an active part in promoting the kinetics of flame reactions. The burning-rate data and the results of ignition experiments are shown to be pertinent to the interpretation of flammability limits. Extinction characteristics of methane are shown to be atypical (compared to other alkanes and alcohols) and demand a special explanation. It is also shown that the assumption of thermodynamic equilibrium at the limits is unrealistic, so there is need for experimental temperature and concentration measurements in both premixed and diffusion flames. When the assumption of equilibrium is removed, the chemical kinetic considerations suggest a simple qualitative explanation of the limit phenomenon, based on the stipulation of incomplete combustion. Quantitative data are presented in support of this view. (Author)

89. Johnson N and Sanderson S
SPILLED FUEL IGNITION SOURCES AND COUNTERMEASURES. FINAL REPORT, MAR 1974-AUG 1975. Ultrasystems, Inc, Phoenix, AZ, Dynamic Sci Div; Dyn Sci-2310-75-118, DOT HS-801-722, 212 pages, Sep 1975
Availability: NTIS PB-245 888/3

The conditions are defined under which motor vehicle crash fires are ignited, along with proposed practicable countermeasures to reduce the incidence of these fires. Both ignition sources and fuel spillage were investigated. It demonstrated, through the mechanics of crash testing, the type of fire safety protection that can be provided by present technology.

90. Rogowski ZW and Pitt A
IGNITION OF FLAMMABLE VAPOURS, GASES AND SHEET MATERIALS BY CATALYTIC HEATERS. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1023, 25 pages, 9 figs, 8 refs, Feb 1975

The incendivity of catalytic beds was tested using propane, ethylene and various saturated paraffins including petrol and pieces of nylon and cellulosic cloth and paper.

It was possible to ignite all gases and vapours with the exception of petrol, when these impinged on the catalytic bed at sufficiently high velocities. When various saturated hydrocarbon liquids were sprayed on to the heated catalytic bed, none ignited. Ethyl ether ignited when a very small volume was sprayed.

It was difficult to ignite sheets of flammable materials. Only cellulosic materials ignited after prolonged direct contact with the catalytic bed. (Author's Abstract)

91. Clodfelter RG
SUMMARY OF IGNITION PROPERTIES OF JET FUELS. Air Force Systems Command, Air Force Aero Propulsion Lab; AFAPL TR-75-70, 54 pages, Sep 1975
Availability: NTIS

In an aircraft environment, jet fuels are exposed to various temperatures and pressures under which flammable vapor-air mixtures may form and be ignited when heated by the surroundings or an external heat source. Other aircraft combustible fluids, such as engine oils, lubricating oils, and hydraulic fluids, also can form hazardous vapor-air mixtures, although the required temperatures are generally higher than for the jet fuels. To assess their ignition hazard level in various practical situations, it is necessary to have a knowledge of the ignition properties of the combustibles when exposed to different types of heat sources. Although such information has been reported for various aircraft combustible fluids, the data are found scattered among many publications. Accordingly, this report was prepared at the request of the Air Force to discuss gaseous ignition processes and to provide compilations of available data on the ignition properties of the aircraft fuels or fluids. The data were taken largely from reports of Air Force sponsored work, including a fire and explosion manual that was recently prepared by the Bureau of Mines. (Author's Abstract)

92. Croce PA
A METHOD FOR IMPROVED MEASUREMENT OF GAS CONCENTRATION HISTORIES IN RAPIDLY DEVELOPING FIRES. Factory Mutual Res Corp; FMRC 21011.3, 23 pages, 8 figs, Jul 1975

A method is described for improving the transient gas concentration measurement in a relatively fast-developing fire or in any changing environment with a characteristic transient time that is comparable to the response time of the sampling system (including analyzer). Under such conditions, the measurements can be significantly altered in both time and magnitude and, hence, be of limited usefulness. The method utilizes the result of a simple laboratory test - the response of the measuring system to a step input - to determine the sampled concentration history from the analyzer record. (Author's Abstract)

93. Naveda OA, Durbetaki P and Wulff W
PROBABILITY OF FABRIC IGNITION UNDER GIVEN EXPOSURE; Paper No. 10
Fire Safety of Combustible Materials Symp, 1st Internat; 1975, Oct 15-17, Edinburgh, Scotland
Sponsor: Univ of Edinburgh, Scotland

The principle is formulated for the quantitative assessment of fabric-related burn injury hazard, and results are presented of ignition probability measurements which are required to relate rationally the hazard to laboratory test methods and to ignition modeling analysis. Burn injury probability is used as the quantitative measure of fabric-related burn injury hazard. The burn injury probability is predicted from the probabilities with which stochastic and deterministic events lead to burn injury. Fabric material properties affect the deterministic events, the first of which is ignition under given exposure conditions. Ignition probability measurements were performed on selected single fabrics exposed to radiative and gas flame heating. The measured ignition frequencies were evaluated by probit analysis and produced the median fabric ignition time and the standard deviation of the mean ignition time. The standard deviation accounts for the stochastic variation of material properties and varies between 0.7 and 6.2 percent of the mean ignition time, depending on heating intensity and initial fabric moisture content. 8 pages, 2 figs, 2 tables, 19 refs (Author's Abstract)

94. Friedman R
IGNITION AND BURNING OF SOLIDS; Paper No. 5
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

This article reviews current knowledge of four stages of fire growth - ignition, smoldering, flame spread, and burning rate of a fully ignited surface. Both cellulosic and thermoplastic combustibles are considered. In each case, the emphasis is that of the combustion scientist who seeks to identify controlling physicochemical mechanisms, and ultimately to be able to make quantitative predictions of behavior based on understanding rather than empiricism.

To summarize the discussion of burning, it is shown that rather small fires may be described by convective mass transfer theory without detailed knowledge of chemistry (except that L, the energy required to pyrolyze a unit mass of the solid, must be known), while larger fires are dominated by radiative transfer, requiring knowledge of flame radiance and flame shape as well as L. The foregoing applies to "simple" fuels, i.e. surfaces which pyrolyze neatly upon being heated, and accordingly burn at a steady rate when a steady heat flux is imposed. The paper ignores complications due to diathermancy of thick thermoplastics, which can cause burning rates to increase slowly with time because of radiative heating in depth, or due to char buildup, especially of cellulosics, which may cause a reduction of burning rate with time. While these transient effects are clearly important, the area of greatest uncertainty at this time appears to be that of the radiative transfer from flame to surface.

In view of the vastness of the subject,

only a few highlights of the literature are discussed; 61 references are provided. Work in progress, insofar as is known to the author, is mentioned. (Author's Abstract)

95. Roberts AF
EXTINCTION PHENOMENA IN LIQUIDS
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 305-313
Sponsor: The Combustion Inst

The flammability of a material depends on complex interactions between material properties and properties of the environment in which it is considered. Preliminary studies have been made of some of these interactions in burning liquids and a simple thermal theory of extinction has been used to interpret these findings. A systematic study of extinction problems is required if flammability testing is to be put on a sound basis and a burner has been developed for this purpose. 3 figs, 10 refs (Author's Abstract)

c. FLOW OF COMBUSTION PRODUCTS

96. Watkins TN
THE BEHAVIOR OF SMOKE IN OLD PEOPLE'S HOMES
Fire, 68(847):393, 396-397, 1976

The panel of the Fire Safety Project Group (UK) has carried out in-depth inspections of a selected number of old age and other residential homes and a series of tests was carried out to determine the behavior of smoke using theatrical smoke. All the premises had smoke detection systems with detectors sited in corridors and escape routes. The tests were not conclusive, and the use of relatively cold smoke prevented simulations of actual fire conditions, which would produce even worse smoke logging. The results indicated that the provision of smoke detectors in escape routes only is inadequate. Consideration of smoke detection in all sleeping areas and circulation areas is recommended.

97. Heselden AJM and Baldwin R
SMOKE PROPAGATION IN THE ESCAPE ROUTES OF BUILDINGS AND ITS CONTROL
VFDB Z, 24(3):87-99, 1975 (German)

The article deals with the propagation of smoke in buildings and the methods that can be used to permit people to escape the building in the case of fire, with emphasis on highrises. The basic principles can also be applied for the same situation in stores, hospitals, residences, etc. The conventional methods of smoke removal in stairwells and emergency exits are inadequate. The development of a method to prevent smoke entering stairwells by slightly increasing the pressure in them is presented. 1 ref. (Author)

98. Hasegawa K, Kojima M and Matsubasi S
STUDY OF THE FLOW BEHAVIOR AND SPREAD OF SMOKE AND TOXIC GASES
Rep Fire Sci Lab (Japan), (11):29-38, 1974 (Japanese)

Results are presented for studies in which the jet and flow parameters of toxic gases and smoke generated by the ignition of specimens of various materials are determined. The jets and flows were produced artificially by forced delivery of smoke and gases from special devices (with excess pressure) as well as naturally, using special diaphragms. The design and operating principle of the monitor-test stands used in the research are described. The principal test stand provided a forced gas flow in a horizontal direction with a flow expansion angle of 60°. Also studied in addition to smoke were the aerodynamic properties of CO, CO(2), HCl and HCN. The flow intensity, jet viscosity, jet delivery rate, and other parameters were measured by a set of 21 special sensors distributed in a vertical plane passing through the center (conventional) axis of the jet. At the same time an analytical aerodynamic calculation was made, taking into account the reference coefficients for each specific gas. Good agreement was obtained between the experimental and analytical data, as illustrated by tables in which the analogous parameters are presented jointly. Experimental data are presented characterizing the specific gasification capacity and the volume naturally occupied when different quantities (per unit area) of wood, vinyl chloride and other plastics are ignited. 2 figs, 8 tables, 4 refs.

99. Fung FCW and Zile RH
SAN ANTONIO VETERANS ADMINISTRATION HOSPITAL SMOKE MOVEMENT STUDY. Nat Bureau of Standards, Center for Fire Res; NBSIR

2. DYNAMICS AND MECHANICS OF FIRE
c. Flow of Combustion Products

75-903, 37 pages, Nov 1975
Availability: NTIS PB-246 859/3GA

A series of full-scale smoke movement experiments was conducted using a sulfur hexafluoride (SF6) gas tracer smoke simulation system. The experiments were designed to study smoke movement in a hospital building with an interstitial space between floors. The penetration of smoke through ceiling and interstitial space and the vertical smoke movement in such a building were investigated. (Author's Abstract)

100. Butlin RN
A REVIEW OF INFORMATION ON EXPERIMENTS CONCERNING THE VENTING OF GAS EXPLOSIONS IN BUILDINGS. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1026, 19 pages, Feb 1975

A review of previous experimental investigations on the venting of gas explosions is presented. Relevant factors are listed, and the extent to which they have been considered and were under positive control in past experiments is discussed. Some of the limitations of previous work are discussed in the conclusions and the points to be considered in future work are outlined. (Author's Abstract)

101. Cox G
GAS VELOCITY MEASUREMENTS IN FIRES BY THE CROSS-CORRELATION OF RANDOM THERMAL FLUCTUATIONS. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1032, 24 pages, Apr 1975

Thermal fluctuations are employed as natural tracers to determine gas flow velocities in fire gases channelled under a ceiling. Results obtained using this cross-correlation technique are in reasonable agreement with those obtained by more conventional methods where interpreation in the presence of turbulence is difficult. (Author's Abstract)

102. Wakamatsu T
CALCULATION METHODS FOR PREDICTING SMOKE MOVEMENT IN BUILDING FIRES AND DESIGNING SMOKE CONTROL SYSTEMS; Paper No. 8 Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

This paper proposes procedures for the design of ventilating systems for buildings based on scientific methods of quantitative evaluation in order to ensure human safety in the event of building fires. The smoke control system is considered as a subsystem of the ventilation system. Design of this subsystem is intended to produce a means for smoke control suited to individual building needs. This is accomplished by computer simulation predictions of smoke flow or pressure distribution in the building. Provision is also made for computations of smoke and gas concentrations and thermal conditions within the building. Three different degrees of complexity of calculation are possible according to the required level of accuracy. As an example of their application, the author demonstrates the design of a smoke control system by means of a simplified method to show that the method can provide simple, quantitative evaluation of the effectiveness of various smoke control systems under different conditions. (Author's Abstract)

d. INSTRUMENTATION

103. Stateham RM and Bowser ML
USING HANDHELD INFRARED IMAGERS TO LOCATE MINERS IN SMOKE-FILLED MINE OPENINGS. US Dept of the Interior, Bureau of Mines; BuMines TPR-87, 11 pages, 8 figs, 6 refs, Feb 1975

Two infrared imagers, both with a 3- to 5-micron spectral range, were tested in a smoke-filled opening to determine their capability to "see through smoke". A mine opening 75 meters long was filled with coal smoke. A fire in a smoke generator and two men were used as targets. The men were detected and identified at 75 meters. Tests were discontinued on the fire because the instruments were saturated with the fire at 25 meters, indicating that fire could be detected at much greater distances. Because of their ability to see through smoke, infrared imagers should be useful during rescue operations in smoke-filled mines. (Author's Abstract)

e. METEOROLOGY

104. Beran DW
ACOUSTIC ECHO SOUNDING SYSTEMS: THEIR POTENTIAL IN FOREST FIRE CONTROL AND RESEARCH
J For, 73(10):633-9, 1975

The acoustic echo sounder described shows promise for measuring stability and other atmospheric phenomena and for monitoring the pattern of air flow superimposed on the ambient atmosphere by an intense heat source, such as a forest fire. It is shown to be particularly well suited for monitoring the depth of stable inversion layers and for providing a qualitative indication of the degree of stability in the lower atmosphere. The addition of a Doppler capability to acoustic systems has also made it possible to sense remotely a vertical profile of the total wind vector to heights of 500 m. 8 refs.

f. RADIATION

105. Kelley CS
PILOTED IGNITION TIME OF WOOD EXPOSED TO TIME-DEPENDENT RADIATION FROM POOLS OF BURNING FUEL
Fire Technol, 11(2):119-31, 1975

This article presents the results of a three-part study, the result of which is that, given the identity of the wood involved, its location from a burning pool, and the initial mass of the burning fuel, one can calculate the time at which the wood will ignite. The limits of applicability are discussed. 7 figs, 2 tables, 14 refs. [Safety in Mines Abstracts].

106. Haegglund B, Jansson R and Onnemark B
FIRE DEVELOPMENT IN RESIDENTIAL ROOMS AFTER IGNITION FROM NUCLEAR EXPLOSIONS.
Foersvarets Forskningsanstalt, Stockholm (Sweden), 30 pages, Nov 1974
Availability: NTIS FOAC-20016-D6-A3

The purpose of the investigation was to improve the knowledge about the early phases of fire development in residential rooms after ignition by thermal radiation from nuclear explosions. Experimental results concerning the time from the irradiation to the beginning of the flame phase, the duration of the flame phase and the maximal burning rate are given for different kinds of upholstered furniture and similar fuels. Results are given concerning the relationship between burning rate, fire ventilation and the occurrence of flashover in small residential rooms with incombustible surfaces. The knowledge gained results in a method for roughly predicting if a flashover is possible in a room, considering the amount and kind of fuel available. (Author)

107. Braven KD
RADIATIVE IGNITION OF SOME TYPICAL FLOOR COVERING MATERIALS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-967, 22 pages, Dec 1975
Availability: NTIS PB-251 413/1GA

The ignition time for some typical floor coverings was measured at varying incident radiant flux levels. A large radiant panel was used as a heat source, with a non-impinging pilot flame 1.0 cm above the sample as an ignition source. Each material was subjected to a range of flux levels. Samples were 5 cm square, mounted horizontally below the radiant panel. A critical flux level, below which ignition did not occur, was determined for each material. (Author)

108. Kashiwagi T
A STUDY OF FLAME SPREAD OVER A POROUS MATERIAL UNDER EXTERNAL RADIATION FLUXES
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 255-265
Sponsor: The Combustion Inst

Characteristics of horizontal flame spread over the surface of a porous material, a carpet in this study, are studied experimentally and theoretically under various external radiant fluxes (0.1-0.27 cal/cm^{2}sec). It is observed that the size of flame is increased significantly by increasing the external radiant flux. This increases the radiative heat feedback from the flame so that it becomes comparable to or greater than the convective heat feedback. The external radiation can also cause an unstable motion of the flame front. This effect is probably due to the production of volatile pyrolysis products ahead of the flame front instead of under it. The theoretical calculation indicates that the thermal emission loss from the heated sample is significant and the internal radiation in the porous material must be included in the model. 7 figs, 2 tables, 18 refs (Author's Abstract)

g. THERMAL CONDUCTIVITY

109. Werthenbach HG
HEAT TRANSFER MODEL FOR TANK FIRES
VFDB_Z, 25(2):57-60, 1976 (German)

In tank fires combustion is maintained by the backflow of heat from the flame into the liquid. At tank diameters of 1 to 2 m and with intensely glowing flames the backflow of heat consists essentially only of the fluxes of radiant heat from the flame/liquid and the tank wall/liquid. With certain simplifications, the backflow of heat can be given as a function of the fire conditions. For liquids without the formation of heat zones the backflow of heat can also be represented by the burning rate, which is easier to determine experimentally. 4 figs, 2 refs.

110. Pagni PJ
AN INTRODUCTORY SUMMARY OF HEAT TRANSFER FUNDAMENTALS RELATED TO FIRE. Univ of California (Berkeley), Fire Res Group; UCB FRG 75-19, 28 pages, 7 figs, 4 tables, 19 refs, Jul 1975
Availability: NTIS

These notes are from a one-day short course given at the Univ of California in 1973 entitled "Understanding Fire Safety" and intended for fire professionals. No background in heat transfer is assumed. The purpose is to provide useful expressions for very approximate heat transfer calculations while conveying the physics of heat transfer phenomena with a minimum of mathematics. Simple examples are drawn from fire-related problems. It is hoped that once this background information is available, similar courses can be directed to practical applications pertinent to this group.

3. BEHAVIOR AND PROPERTIES OF MATERIALS

[For literature on fire and flame retardants, fire and flame proofing, etc see Chemical_Abstracts.]

a. CHARACTERISTICS AND THERMAL BEHAVIOR OF MATERIALS

111. Durbetaki P, Wedel GL and Wulff W
FLAME-FABRIC INTERACTION DURING PREIGNITION PROCESSES; Paper No. 75-HT-12
Heat_Transfer__Conf,__15th_Nat; 1975, Aug 11-13, San Francisco, CA
Sponsor: Am Soc Mech Engrs/Am Soc Civil Engrs

Cellulosic fabrics release water and pyrolyze during preignition processes. The resulting blanket of vapor and pyrolysate interferes with the heat transfer between the pyrolyzing solid and its environment, particularly with an igniting gas flame in the case of convective heating. The insulating effect from the evolving pyrolysate is similar to that of injection cooling. Measurements were performed with inert stainless-steel screens exposed to normally impinging flames of known characteristics in a specially constructed Convective Ignition Time Apparatus. The screens simulate the fabric and at the same time serve as one leg of a thermocouple to sense its transient mean temperature. The volatile evolution is simulated by injecting preheated air through the screen. The heat transfer from the gas flame to the screen was inferred from the screen's temperature rise, following its sudden exposure to the flame. The measurements are evaluated on the basis of a modeling analysis. The convective film coefficients determined in this investigation are applied to predict fabric ignition times. 8 pages, 6 figs, 1 table, 23 refs (Author's Abstract)

112. Miller B and Turner R
THE THERMAL AND COMBUSTION BEHAVIOR OF CELLULOSE-POLYAMIDE MIXTURES; Paper No. 61

Cellulose Conf, 8th, Proc; 1975, May 21, Syracuse, NY
Sponsor: Cellulose Res Inst (SUNY) and Tech Assoc of the Pulp and Paper Industry

An experimental study has been carried out to ascertain the nature and extent of the interactions occurring during thermal decomposition and combustion of cellulose-polyamide mixtures. By varying the arrangement and degree of intimacy of the mixtures and using a battery of techniques for analyzing evolved and residual products, evidence has been accumulated which indicates that a volatile early decomposition product of a nylon can react with cellulose. The result is a chemically modified cellulose with sufficiently altered thermal behavior so as to affect its subsequent flammability. The same effect can be achieved by heating cellulose in the presence of ammonia. The results and conclusions are relevant to the problem of prediction and controlling the potential fire hazard of materials containing these two polymers. 13 figs, 5 tables, 5 refs (Author's Abstract)

113. Chang EP, Kirsten R and Salovey R
DYNAMIC MECHANICAL AND THERMAL PROPERTIES OF FIRE-RETARDANT POLYPROPYLENE
Polym Eng Sci, 15(10):697-702, 1975

A study of the effect of a series of fire retardants and antimony oxide upon the dynamic mechanical and thermal properties of polypropylene suggests three categories. (1) "Inert Fillers" - These raise the elastic modulus and the heat distortion temperature of polypropylene without shifting its glass transition temperature. The melting point of polypropylene is only depressed by 1-3°C; the heat of fusion and the percentage of crystallinity of polypropylene in these composites is approximately 10 percent lower at additive concentrations of about 30 percent. Very poor interaction exists between the additive and the thermoplastic, which apparently exist in two separate phases. (2) "Chain Stiffeners" - These raise the elastic modulus (approximately 25 percent) and the glass transition (about 11°C) for polypropylene; the melting point of polypropylene in the composite is lowered by about 6°C, indicative of good interaction between the additive and polypropylene. (3) "Plasticizers" - These lower the room temperature elastic modulus (approximately 20 percent) and the glass transition temperature (approximately 11°C) of polypropylene; the melting point of polypropylene in the composite is depressed by about 10°C indicating a good interaction. The efficacy of the "plasticizers" and "chain stiffeners" are attributed partially to melting of polypropylene at the processing temperature. 3 figs, 4 tables, 30 refs. (Author)

114. Pohl KD
EXPERIMENTAL STUDIES OF THE FIRE PHENOMENON WITH SPECIAL CONSIDERATION OF FIBROUS MATERIALS
Melliand Textilber, 57(1):72-78, 1976 (German)

Within the framework of systematic studies to determine the cause and development of fires from the scientific legal viewpoint, the thermal characteristics of several materials of natural and synthetic origin were investigated. Devices are presented for measurement of the flash-ignition and self-ignition temperatures, burning rate, real calorific value, smoke development, and toxicity of smoldering or burning gases. The measurement data are presented and discussed. 14 figs, 11 refs. (Author)

115. Vaughan F
THE BEHAVIOUR OF TILES AND ADHESIVES IN FIRE CONDITIONS
Fire Prot Rev, 39(423):77,79, 1976

Tests carried out by the Rubber and Plastics Research Association (UK) indicate that ceramic wall and floor tiles may delay the spread of fire to a great extent by insulating the background from the effects of fire. None of the adhesives tested, including polyvinyl acetate and epoxy resin, contributed significantly in terms of smoke or toxic gases to the hazard already present in a fire.

116. Raynham EA
FIRE SAFETY WITH FIBRE BUILDING BOARD
Fire Prot Rev, 39(423):83,85,87, 1976

The director of the Fibre Building Board Development Organisation (UK) defends the positive-predictable fire resistance properties of combustible materials such as fiberboards by citing tests in which linings of such materials exhibited favorable results compared to insulation and other materials.

3. BEHAVIOR AND PROPERTIES OF MATERIALS

a. Characteristics and Thermal Behavior of Materials

117. Tewarson A and Pion RF
BURNING INTENSITY OF COMMERCIAL SAMPLES OF PLASTICS
Fire_Technol, 11(4):274-81, 1975

A novel way of expressing burning intensity has been derived from burning rate data by varying ambient oxygen and applying additional heat flux to the burning samples. The objective of this study was to develop a laboratory-scale test to evaluate the flammability components of plastics, so that the evaluations can be used to determine the fire hazard and corresponding protection requirements of plastic products in full-scale fires. 14 refs.

118. Finnerty AE
THE EFFECT OF HALONS ON THE AUTOIGNITION OF PROPANE
Combustion_Inst__Meeting,__Western_States Section,__Fall__1975; 1975, Oct 20-21, Stanford Res Inst, Menlo Park, California
Sponsor: Combustion Inst, Western States Section

The autoignition of propane-halon mixtures with oxygen has been studied in a static system at subatmospheric pressures and temperatures over 500°C. Ignition delays and pressure increases accompanying combustion were measured. The pressure-time data were applied to a Semenov expression for a branching chain reaction to calculate the initial rate of production of free radicals and the net branching factor for the oxidation of propane with and without halons.

Surprisingly, it was discovered that halon compounds, such as halon 1301, 233 and 1011, instead of inhibiting the ignition of propane, actually act as ignition promoters.

Since the halons promote ignition, it is necessary to conclude that the parent halon compound does not act as a radical trap at 500°C and subatmospheric pressure. The halon is acting as a large inert gas molecule hindering the diffusion of free radicals to the reactor walls, where radicals are normally destroyed.

Since halons are known to be excellent fire extinguishing agents, we conclude, assuming a chemical basis for flame quenching, that a product species, probably a hydrogen halide, formed from the halon in the flame is the true combustion inhibitor. In our autoignition experiments, the inhibitor is not formed until after an explosion has occurred, at which point the reaction is complete. In cases where a halon is to be chosen as a fire extinguishant, attention should be given to the case of formation of the hydrogen halide and the amount obtainable from the parent halon. 25 pages, 7 figs, 6 tables, 8 refs. (Author)

119. Christopher AJ
SOME ASPECTS OF SMOKE AND FLAME EVOLUTION FROM OVERHEATED NON-METALLIC MATERIALS;
Paper No. 11
Aircraft_Fire__Safety,__AGARD__Propulsion and_Energetics_Panel_Meeting,_45th,_Proc, Oct_1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

A dynamic system for assessing the smoke and fume emission characteristics of nonmetallic materials is described. A sample of the material under examination is heated from ambient to 500°C in a stream of air. The behavior of the material under in-flight electrical overheating conditions is simulated. Sample temperature, smoke density, and electrode response in a water bubbler are monitored. Results obtained for various materials are presented and discussed. 12 pages, 8 figs, 4 tables, 7 refs. (Author)

120. Fang JB
MEASUREMENTS OF THE BEHAVIOR OF INCIDENTAL FIRES IN A COMPARTMENT. Nat Bureau of Standards; NBSIR 75-679, 29 pages, Mar 1975
Availability: NTIS COM 75-10419

A variety of upholstered chairs and wood cribs were burned within a ventilated compartment. The experimenal measurements of weight loss, smoke concentration, temperature and heat flux levels are summarized. A reproducible fire obtained from burning a standardized wood crib array was found to be capable of representing the essential features of incidental fires of moderate intensity.

121. Min K
DYNAMICS OF PYROLYSIS OF CELLULOSIC MATERIALS. Harvard Univ, Div of Eng and Applied Physics; 38 pages, 11 figs, 13 refs, Feb 1975

An experimental investigation is conducted with the objective of studying the process of migration, condensation and regasification of the volatiles generated during the pyrolysis, and the effect such process might have on the apparent overall kinetics of pyrolysis.

In the first part of the study, the pyrolysis sample consists of cellulose powder diluted with inert aluminum oxide powder to maintain constant physical properties during the pyrolysis. Tests in air show large exothermic effect, but the thermal effect of pyrolysis in an inert atmosphere is found to be small. Pressure measurement shows generation of volatiles. No clear indication of volatile condensation and regasification (similar to those noted in the earlier study of the drying process) was observed.

Heating a layer of the pyrolysis mixture over a layer of pure inert powder leaves residue in the inert powder, showing that migration of volatiles towards the cooler interior does indeed occur. No quantitative estimate of the magnitude of migration is yet possible, although it appears to be small. The experiment also shows that regasification of the condensed volatiles is not simply re-evaporation but accompanied by chemical decomposition which leaves solid residue. This is further confirmed in the second part of the study.

Theoretical analysis of the condensation and regasification process is hampered by the complexity of the process and a lack of knowledge of the properties of the volatiles.

The second part of the study makes use of the vapor phase thermal analysis technique [RH McCarter, J Appl Polymer Sci, 17:1833, 1973].

Tests on filter paper samples at different heating rates in the range of 3 to 30°C/min yield a single set of Arrhenius kinetics parameters. The value of the activation energy determined from the slope of the individual Arrhenius plot is 56 kcal/mole, which is in close agreement with the value calculated from the observed variation of the temperature at which maximum rate of pyrolysis occurs, with the rate of heating.

Condensation of the volatiles in a downstream section results in reduced gas detector response but little change in the apparent overall kinetics. When the condensate is heated it regasifies. The regasification is complete before the condensate reaches a temperature of 200°C and only a fraction of the condensate is gasified.

Tests with wood veneer samples yield results which show contributions from its principal components, viz. hemicellulose, cellulose and lignin. (Author's Abstract)

b. COMBUSTION AND FLAMMABILITY TESTS AND METHODS

122. Tatem PA and Williams FW
DEVELOPMENT OF FIRE PERFORMANCE TESTS FOR CARBON-IMPREGNATED POLYURETHANE FOAMS
Ind_Eng_Chem_Prod_Res_Div, 14(3):204-210, 1975

Several carbon-impregnated polyurethane foams were evaluated under burning and pyrolysis conditions with the intent of devising testing procedures for judging their fire safety. The tests were formulated for anechoic chamber material and are intended to assure that a polyurethane foam material classified as fire safe has the ability to self-extinguish deep-seated combustion as well as external or visible flame produced from different sources of ignition. In addition, the tests assess the hazards these foams create by measuring the toxicity levels produced under fire and thermal degradation. 3 figs, 3 tables, 10 refs. (Author)

123. Kahnau HW and Kieninger W
FIRE-SAFETY TESTING OF MOLDINGS MADE OF THERMOPLASTIC SYNTHETICS
Elektrotech_Z, B28(1):2-9, 1976 (German)

The hot-wire and microburner methods (VDE 0471 Part 2/4.75 and Part 5/9.75) are suitable for differentiating combustion behavior of thermoplastics by the parameters temperature, ignition and secondary burning times, and flame height. They permit informed selection of thermoplastics by type, thickness and geometric stability as well as by dripping of burning parts as a function of location of the molded part in the assembly. The test criteria should be adequate to define the burning behavior of thermoplastic moldings toward latent ignition sources in appliances of the low-voltage industry and to specify this behavior in appropriate appliance regulations. 2 figs, 3 tables, 3 refs. (Author)

124. Nelson GL
OXYGEN INDEX, FLAMMABILITY AND MATERIALS
Adv_Fire__Retard__Text,__Prog_Fire_Retard Ser, 5:271-370, 1975

The behavior of materials to fire

stress can be described in a number of different ways, such as ease of ignition, flame spread, fire endurance, fuel contribution, and smoke evolution, among others. A multitude of tests has been developed to measure one or more of these properties. Current fire tests in different countries reveal a considerable variance. One of the most widely used smallscale tests is the oxygen index test. It is the purpose of this review article to describe in detail what it measures and what it does not measure. 68 figs, 36 tables, 119 refs. (Author)

125. LaCrosse RA
INSULATION BOARD INDUSTRY AND SOUND-DEADENING BOARD
Fire J, 70(3):45-48, 1976

Smoldering sound-deadening board ignitions, often by workmen's torches or other open flames, result in subsequent fires with considerable structural damage. The background of the insulation board industry and the steps being taken to alleviate the above-mentioned situation by the development of a smoldering ignition test procedure and an energetic educational program directed toward contractors, workmen and others involved are discussed. 2 figs, 3 refs.

126. Abbott C
MEASUREMENT OF CRITICAL OXYGEN INDEX OF FLAMMABLE MATERIALS
Kunstst Plast, 22(9):53-5, 1975 (German)

The author critically discusses the flammability test, known as "Oxygen Index," in applications for assessment of plastics designed for building applications. Materials testing apparatus used in the United Kingdom is described in some detail along with its operation techniques, performance and limitations. It is pointed out that the oxygen index method is particularly suitable for comparison of two or more flammable materials.

127. Dalhoff W, Spitzlei H and Johannson G
FIRE TESTING OF CHEMICAL MATERIALS (Conclusion)
VFDB Z, 25(1):29-31, 1976 (German)

About 30 percent of the synthetic materials produced in the Federal Republic of Germany are used in the building industry. According to the theory of statistical probability, such materials will be involved in fires more than any other combustible material. Following a survey of the fire properties of building materials and structural elements, fire protection by means of smoke and heat venting is discussed. Laboratory test results from acrylic and fiberglass are also described. The decisive factor in selecting the building material is the required and anticipated fire behavior of the synthetic materials. 7 figs, 7 refs.

128. Hilado CJ
FLAMMABILITY TESTS, 1975: A REVIEW
Fire Technol, 11(4):282-93, 1975

The author identifies the numerous tests designed to describe the flammability characteristics of materials and discusses some of the more widely used ones. The test procedures promulgated by various organizations are listed.

129. Krasny JF and Winger JH
CURRENT STATUS OF FLAMMABILITY TEST DEVELOPMENT AT THE NATIONAL BUREAU OF STANDARDS
Fabric Flammability Information Council Meeting, 7th Annual, Proc; 1973, Dec 5, New York, NY

The tests for the flammability of textile items that are presently under development at NBS are described. 5 pages

130. Stoll AM, Munroe LR, Chianta MA, Piergellini JR and Zaccaria DE
A FACILITY AND METHOD FOR EVALUATION OF THERMAL PROTECTION. Nav Air Dev Center, Crew Systems Dept, Warminster, PA; NADC 75286-40, 19 pages, Dec 1975
Availability: NTIS AD-A021 234/0GA

The facility described is a fuel fire pit with ancillary equipment and instrumentation to provide for exposure of full-scale, clothed manikins to total flame envelopment under precisely controlled conditions. The method is designed to yield predictions of the proportion of surface area of a living subject expected to be burned under the experimental garment given the same exposure conditions. The ultimate purpose of the procedure is to provide realistic evaluations of the protective capacity of personal gear worn by aircrew personnel subjected to the hazard of fire contact, particularly that occasioned by aircraft in carrier deck crashes. (Author)

131. Higginbottom GS
INVESTIGATION OF NOMEX AND BETA-FIBERGLASS CARPETING MATERIALS FOR SHIPBOARD USE. Navy Clothing and Textile Res Unit, Natick, MA, 30 pages, Jun 1975
Availability: NTIS AD-A013 333

Flammability tests led to the selection and approval of Nomex and Beta-fiberglas carpeting for shipboard use. Selected laboratory tests were performed to develop the necessary information. Analyses of test results indicate that Beta-fiberglas offers the best abrasion resistance, the most resilience after compression and the highest degree of fire resistance. Nomex carpeting possesses the best resistance to spots and stains, does not develop static electricity, and is more resistant to soiling. Proposed specifications based mainly on laboratory tests have been prepared. (Author)

132. Affens WA, McLaren GW and Hazlett RN
FLAMMABILITY AND IGNITION PROPERTIES OF JP-5 JET FUEL FROM ALTERNATE SOURCES. Nav Res Lab; NRL MR-3191, 15 pages, Dec 1975
Availability: NTIS AD-A020 048/5GA

The flammability and ignition properties of JP-5 from alternate sources were studied. The samples which were investigated included one derived from tar sands, one from shale oil, and five from coal. The tar-sand, shale-oil, and one of the coal samples had flash points which were below that of the 140°F specification requirement. The remaining fuels from coal had flash points which were higher than specification requirements, and also higher than those of the usual run petroleum JP-5. Flammability indices and flammability index-temperature relationships of the alternate fuels were found to differ somewhat from that of the petroleum fuels. Autoignition temperatures of the alternate fuels were similar to that of petroleum-derived fuels. In general, the flammability properties of the JP-5 from alternate sources were not significantly different from that of JP-5 from petroleum. (Author)

133. Arnault P, Ehm H and Kruppa J
REAL FIRES WITH FURNITURE AND PAPER. Centre Technique Industriel de la Construction Metallique (France); Doc No 2.10.20-3, 22 pages, 25 figs, 3 tables, 5 refs, Jul 1974 (French)

By using a fuel very similar to that which feeds real fires it was possible to approximate actual fire conditions. For instance, it was found that the contribution of paper to fires is far from what is found using a heat pipe; at equal fire load, the temperature is maximum if the fuel is composed of well-spaced pine slats. If it is desired to compare the results with pine-wood tests, corrections must be made to the calculation of heat load due to paper. According to the tests, with paper representing 23-65% of the total fire load, the real fire load corresponds generally to only two thirds of the total fire load. In addition, this value is even lower for office furniture, because the paper portion is greater than used in these tests. According to a statistical analysis, it represents at least 75% of the total fire load. This percentage varies from 27% in conference rooms to 92% in libraries and archives; it is 82% in office rooms. (Author)

134. Kayser EG and Boyars C
SPONTANEOUSLY COMBUSTIBLE SOLIDS - A LITERATURE SEARCH. Nav Surface Weapons Center, White Oak Lab, Silver Spring, MD; NSWC WOL TR-75-159, 36 pages, May 1975
Availability: NTIS AD-A019 919/0GA

Existing information on spontaneously combustible solids including pyrophoric-air hazardous materials and water reactive materials has been reviewed. Pertinent data on (a) the causes and prevention of spontaneous combustion in organic and inorganic materials due to air and water reactivity, (b) the application of various mathematical treatments to spontaneously combustible materials, and (c) available test methods for assessing the flammable properties of spontaneously combustible materials, e.g., autoignition temperature and spontaneous heating, are also included. (Author)

c. FIRE AND EXPLOSION HAZARDS OF MATERIALS

135. Sharrod D and Edser MH
FIRE HAZARD CHARACTERISTICS OF SOME LATEX AND EMULSION POLYMERS USED IN TEXTILES
Text_Inst_Ind, 14(3):79-82, 1976

Smoke emission characteristics in flaming and smoldering conditions were determined for 40 polymers. In general, flaming conditions produced somewhat higher maximum smoke density (Dm) and a much higher rate of smoke buildup. Under flaming conditions the conventional vinyl acetate copolymers, vinyl acetate-ethylene copolymers, all-acrylics, and polyvinylidene chloride grades gave the lowest Dm values; taken in conjunction with the speed of smoke development, the most satisfactory polymer groups examined appeared to be vinyl acetate-ethylene copolymers, and all-acrylic or high-acrylic copolymers, and these are most likely to repay detailed study in conjunction with textiles. 3 figs, 2 tables, 2 refs.

136. Korol'chenko AYa, Ivanov AV and Aristova EM
FIRE AND EXPLOSION HAZARD OF FLUORENE AND ITS DERIVATIVES
Khim_prom, (12):903, 1975 (Russian)

Given are the results of an experimental determination of the basic characteristics of the fire and explosion hazard of fluorene and its derivatives. The explosion hazard of the aerosols was assessed from the value of the lower flammability limit. The data are given in two tables, the experimental values of the lower flammability limit being compared with the theoretical values in table 2. 2 tables, 6 refs.

137. Monakhov VT
STUDY OF THE FIRE SAFETY OF SUBSTANCES
Pozhar_okhrana, 1:5-49, 1974 (Russian)

Modern methods of computational and analytical evaluation of the fire hazard of chemical substances are presented, including concentration and temperature limits of ignition, flash temperatures, ignition and self-ignition, minimum retarding temperatures, and the rate of burnoff of liquids from a free surface. The use of the "combustibility enthalpy" method for the computational and analytical assessment of the fire hazard of substances is described. A critical survey of modern experimental methods of evaluating the fire hazard of substances is given and the most important results of experimental research of the past few years are presented. 7 tables, 161 refs.

138. Meckel L and Rook A
ASSESSMENT OF THE FIRE HAZARD OF TEXTILES
Melliand__Textilber, 57(1):58-64, 1976 (German)

A survey is given of the factors that influence and characterize the combustion behavior of textiles. Statistical data permit estimation of the fire hazard in connection with textile products. The fire hazard is compared with other hazards. Possibilities of reducing the potential causes of fire in textiles are discussed, and the conclusion drawn is that obligatory labelling of the combustion behavior of textiles would not be of much general use. 8 tables, 14 refs. (Author)

139. Tovey H and Vickers AK
HAZARD ANALYSIS OF FIRES INVOLVING BLANKETS
Text_Chem_Color, 8(2):19-22, 1976

Available data on accidental fires involving blankets were analyzed to identify the hazards associated with blanket ignitions. The most detailed of these data, from the Flammable Fabric Accident Case and Testing System (FFACTS), indicate that blankets are the 12th most frequently ignited fabric item in the data base. Among fabric items which ignited first in FFACTS fabric fires, they rank 10th, accounting for about 5 percent of the total first-to-ignite fabric items. Of 62 first-to-ignite blankets in FFACTS, 35 (56 percent) were electric blankets, 34 of which ignited from the blanket wiring itself.

Other fabric items appear to present a greater flammability hazard than blankets. However, since decisions concerning flammability standards must be based not only on hazard level, but also on consideration of technological practicability and economic impact, these factors will have to be investigated before a firm recommendation can be made. 8 tables, 9 refs. (Author)

140. Lovelock RT
THE FLAMMABILITY OF COMPONENTS
Electron Ind (GB), 1(2):39,41, 1975

Discusses the fire danger of electronic assemblies which often form a chimney. The use of plastics and danger of flammable vapor emission at elevated temperatures are considered. Test methods, the need for their standardization, and the responsibilities of the component supplier and of the equipment supplier are discussed.

141. Hardee HC and Lee DO
EXPANSION OF CLOUDS FROM PRESSURIZED LIQUIDS
Accid Anal Prev, 7(2):91-102, 1975

In recent years there have been accidents in which railroad or vehicular tanks filled with hazardous liquids such as propane, butane, ammonia, sulfur dioxide, gasoline and kerosene have been ruptured. A mathematical model has been developed for the resultant cloud, breaking the process down into three stages. The first stage covers fuel expansion owing to a drop in pressure to atmospheric. This two-phase flow expansion is assumed to be entropy expansion. The total momentum is calculated and is then used to calculate the second and third stages, when the cloud radius is increased by the increasing energy. As the cloud grows, it absorbs the surrounding air and, when the momentum is constant, the rate of expansion decreases with incrasing size. During the second stage, the warm air vaporizes the remaining fuel droplets, the pool continues to evaporate, and the height of the cloud increases with increasing radius. In the third stage the height becomes constant and the cloud expands only radially as a result of the energy liberated in the initial expansion to atmospheric pressure. The equations are verified experimentally using liquefied gases. 12 figs, 10 refs.

142. Vickers A, Krasny JF and Tovey H
SOME APPAREL FIRE HAZARD PARAMETERS
Fabric Flammability Information Council Meeting, 7th Annual, Proc; 1973, Dec 5, New York, NY, pages 205-226
Sponsor: The Cotton Foundation, Memphis, Tenn
Availability: NBS AD-247 026/8GA

The effect of three parameters, fiber content, fabric burn time (a function of ease of ignition and rate of flame spread), and garment configuration and fit, on frequency of involvement in accidential garment fires and on the extent of resulting injury was investigated using fabrics and data from the NBS Flammable Fabric Accident Case and Testing System.

143. Arvidson JM, Hord J and Mann DB
EFFLUX OF GASEOUS HYDROGEN OR METHANE FUELS FROM THE INTERIOR OF AN AUTOMOBILE.
Nat Bureau of Standards; NBS TN-666, 56 pages, Mar 1975
Availability: GPO SD Catalog No. C13.46: 666

Gasoline-powered automobiles are being converted to operate on gaseous fuels such as H_2 or CH_4. These fuels are commonly stored in containers located in the trunk of the car. Potential leakage of these gaseous fuels into the passenger compartment of the vehicle constitutes a safety threat. Definitive experiments were performed to identify the explosion hazards, establish venting criteria and obviate general safeguards for H_2 or CH_4 fueled passenger vehicles. Appropriately designed ventilation systems significantly reduce the safety hazards associated with accumulated combustible gases. Vents are recommended for all autos converted to burn H_2 or CH_4 and may possibly be eliminated in new cars that are designed for gaseous fuel operation. Combustible gas warning systems are recommended, at least in the interim, for all (converted and newdesign) gaseous fueled vehicles. H_2 and CH_4 gases appear equally safe as vehicular fuels if used in properly designed vehicles.

144. Woolley WD and Ames SA
THE EXPLOSION RISK OF STORED FOAMED RUBBER. Building Res Estab (UK), Fire Research Station; BRE CP-36-75, 7 pages, 5 figs, 1 ref, Apr 1975

A fire occurred recently in a store room containing foamed rubber mattresses which led to an explosion of a hitherto unknown type which caused two deaths and some serious injuries.

The incident was investigated as a matter of urgency at the Fire Research Station and this report describes experimental work which has been carried out to study the flammability and explosibility of the products from the burning and smouldering of foamed rubber.

The work has shown that a serious explosion risk exists when the flammable smoke and vapours from the smouldering of foamed rubber are allowed to collect in an enclosed space. (Author's Abstract)

145. Parker WJ, Paabo M, Scott JT, Gross D and Benjamin IA
FIRE ENDURANCE OF GYPSUM BOARD WALLS AND CHASES CONTAINING PLASTIC AND METALLIC DRAIN, WASTE AND VENT PLUMBING SYSTEMS.
Nat Bureau of Standards, Building Res Div; NBS BSS-72, 116 pages, Sep 1975
Availability: NTIS PB-247 537/4GA

The use of plastic pipe in plumbing systems of multiple-occupancy buildings has raised considerations regarding fire safety. To provide needed data, ten full-scale fire endurance tests were performed involving a total of 39 plumbing chase and wall assemblies containing plastic and metal drain, waste, and vent (DWV) systems typical of installations serving one or two story buildings. Two tests were conducted using plumbing chase configurations simulating kitchen sink drain systems. Six fire endurance tests were conducted in which the performance of ABS, PVC, copper and iron was compared directly in kitchen sink drain systems as installed in wood-stud and gypsum-board walls.

146. Palmer KN, Taylor W and Paul KT
FIRE HAZARDS OF PLASTICS IN FURNITURE AND FURNISHINGS: FIRES IN FURNISHED ROOMS.
Building Res Estab (UK), Fire Res Sta; BRE CP-21/76, 57 pages, 24 figs, 6 tables, 3 refs, Feb 1976

The final phase of a 3-year contract on the fire hazards of plastics in furniture and furnishings is described. The third year's work was mainly on the burning of furnished rooms; measurements were made of temperature, smoke density and composition of fire gases as the fire proceeded.

A sequence of well-ventilated fires involving sitting/dining-room furniture, showed that traditional furniture was relatively difficult to ignite with a small flame and underwent a period of smouldering; when flames reestablished themselves the fire developed slowly producing less smoke than furniture containing rubber or polyether foams. Modern sitting/dining room furniture was readily ignited and burned rapidly evolving considerable quantities of smoke. Its flammability could however be reduced by improved covering and filling materials and by the provision of a flame-retardant interlining between the foam and the upholstery fabric. In a sequence of four tests involving the progressive substitution of less flammable fabrics and foams, and the use of interlining, the flammability of a modern suite was reduced and resembled that of traditional furniture. The implications of these findings are discussed.

In bedroom fires modern furnishings burned more rapidly than traditional but could be improved by the careful selection of bedding materials. A fire in a bedsitting room, furnished in a modern style, developed rapidly with considerable production of smoke. Fire spread was probably assisted by there being a great deal of furniture in the room, so that when a piece of furniture caught fire it could quickly set the pieces next to it alight. A similar pattern was found in a hotel bar fire where the number and close proximity of seats and small tables enabled fire to spread rapidly.

Modern office furniture burned more rapidly than the traditional, and the use of structural foams in furniture gave rise to a severe smoke problem even after the fire temperature had decreased considerably. At their present state of development, structural foams in furniture could hinder the escape of occupants in the event of a fire.

Polypropylene upholstery fabrics gave no protection against fire, were readily ignited, and should be regarded as a hazardous upholstery fabric. (Author)

d. NATURE OF COMBUSTION PRODUCTS

147. Zinn BT, Cassanova RA, Powell EA, Bankston CP and Tsoukalas SN
EXPERIMENTAL DETERMINATION OF THE PHYSICAL AND CHEMICAL PROPERTIES OF SMOKE
Flammability of Materials Conf, Polymer Conf Series; 1975, Jul, Univ of Utah, Salt Lake City, Utah
Sponsor: Univ of Utah

The material presented in this paper demonstrates that detailed determination of the physical and chemical properties of the particulate and gaseous products generated by the burning of different materials under different environmental conditions is currently possible. The physical properties of the smoke can be determined by both sampling and _in situ_ measurement techniques, and the measured sets of data agree well with one another. The measured data shows the particle diameter of smoke produced by burning different materials is in the one micron range. This data also shows that the quantities and the mean diameter of the generated smoke are strongly dependent upon the heat flux, and they both increase with increasing the radiant heat flux. Preliminary chemical analysis conducted to date shows that the smoke production problem in plastics may be directly related to the various additives that are incorporated in these materials. 34 pages, 14 figs, 2 tables, 22 refs (Author's Abstract)

148. Grupp H
CORROSIVE ACTION OF FIRE GASES CONTAINING HYDROCHLORIC ACID AND ITS MODIFICATION BY HUMIDITY
Maschinenschaden, 48(4):119-124, 1975
(German)

Considered are aspects of the corrosive action of gaseous products of the pyrolysis of polyvinylchloride containing hydrochloric acid vapor and water. Such reactions are observed when the vapor condenses on the surface of various substances and materials. The dependence of these processes on the humidity of the surrounding air is shown. 7 figs, 15 refs.

149. Marcussen WH, Leon HA, Kourtides DA, Parker JA, Butte JC and Cummins JM
APPARATUS AND METHODOLOGY FOR FIRE GAS CHARACTERIZATION BY MEANS OF ANIMAL EXPOSURE
J Combust Toxicol, 3(1):24-31, 1976

There is a need for reliable methods for characterizing the nature of the gases produced in full-scale fire tests, particularly with regard to their effect on biological systems. While there is a great deal of information available from small-scale laboratory experiments and for relatively simple mixtures of gases, considerable uncertainty exists regarding appropriate bioassay techniques for the complex mixture of gases generated in full-scale fires.

Apparatus and methodology have been developed, based on current state of the art, for determining the effects of fire gases in the critical first 10 minutes of a full-scale fire on laboratory animals. This information is presented for its potential value and use while further improvements are being made.

150. Einhorn IN, Chatfield DA and Mickelson RW
ANALYSIS OF THE PRODUCTS OF THERMAL DECOMPOSITION OF AN AROMATIC POLYAMIDE FABRIC USED AS AN AIRCRAFT INTERIOR MATERIAL; FRC UU-42, UTEC 75-025
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: Advisory Group for Aerospace R and D/NATO

For abstract see abstract 154. 35 pages, 9 figs, 7 tables, 13 refs

151. Bankston CP, Cassanova EA, Powell EA and Zinn BT
PROPERTIES OF SMOKE PRODUCED BY BURNING WOOD, URETHANE, AND PVC SAMPLES UNDER DIFFERENT CONDITIONS
Flammability and Burning Characteristics of Materials and Fuels Meeting, Combustion Inst, Joint Central and Western States Sections, Spring; 1975, Apr 21-22, San Antonio, Texas
Sponsor: The Combustion Inst

This paper describes results obtained in a series of small-scale tests investigating the properties of the combustion products generated during the burning of samples of wood, rigid urethane foam and PVC plastic under nonflaming conditions, in a recently developed ventilated combustion products test chamber. Ventilation gas compositions and radiant heating levels were varied to simulate real-fire situations. Smoke particle size distributions are determined through sampling techniques utilizing a Whitby aerosol analyzer and an Anderson sampler (i.e. a Cascade impactor). A particle mass monitor gives data on mass of particulate per unit volume of ventilation gas. Also, the weight loss of each sample is continuously measured during each test. Available results provide quantitative and qualitative data on the burning rates of the samples and properties of the particulate matter generated by burning the above-mentioned materials. Difference in smoke properties are evident as burning conditions vary. 31 pages, 6 figs, 3 refs (Author's Abstract)

3. BEHAVIOR AND PROPERTIES OF MATERIALS
d. Nature of Combustion Products

152. Woolley WD and Raftery M
TOXIC PRODUCTS OF COMBUSTION OF PLASTICS. Building Res Estab (UK), Fire Res Center; BRE CP-22/76, 2 figs, 24 refs, Mar 1976

This paper considers the toxicity of plastics in fire situations in the light of the increasing use of such materials in the structure and furnishings of buildings.

153. Sarkos CP
MEASUREMENT OF TOXIC GASES AND SMOKE FROM AIRCRAFT CABIN INTERIOR MATERIALS USING THE NBS SMOKE CHAMBER AND CALORIMETRIC TUBES. Nat Aviation Facilities Experim Center; FAA NA-75-54, FAA RD-76-7, 62 pages, Mar 1976
Availability: NTIS AD-A023 413/8GA

Seventy-five 'self-extinguishing' materials used in widebodied aircraft cabin interiors were tested in the National Bureau of Standards Smoke Chamber and analyzed for smoke and toxic gases in the combustion mixture. Concentrations of selected toxic gases were measured at regular intervals during the test, either directly from the chamber or from bag samples, using colorimetric detector tubes. Data analysis was facilitated by grouping the materials into usage designations and comparing the peak smoke and toxic gas concentrations. Despite the unknown magnitude of interference effects in the combustion mixture, detector tubes appear to offer a convenient and inexpensive method for identifying the presence of selected gases and approximating the relative gas yield of similar cabin materials. (Author)

154. Chatfield DA, Einhorn IN and Mickelson RW
ANALYSIS OF THE PRODUCTS OF THERMAL DECOMPOSITION OF AN AROMATIC POLYAMIDE FABRIC AS AN AIRCRAFT INTERIOR MATERIAL. Univ of Utah, Flammability Res Center; FRC UU-42, UTEC 75-025, 36 pages, 9 figs, 7 tables, 13 refs, Jan 1975

An aromatic polyamide used in the interior of wide-bodied commercial jet aircraft was selected for study. A program was designed to characterize this polymer and to identify the products of degradation resulting from pyrolysis, oxidative degradation, and flaming combustion. Special emphasis was directed toward obtaining a complete material balance so as to serve as the basis for further mechanistic studies pertaining to modes of polymer thermal decomposition. The qualitative and quantitative analysis of the products resulting from the material degradation is serving as the basis of animal bioassay experiments designed to predict potential physiological and toxicological hazards to humans during fire exposure. The methodology reported is also being used to provide input for computerized modeling studies directed toward prediction of smoke obscuration and product distribution which may result during aircraft fires. This research is thus directed toward providing the engineering design criteria which will serve as the basis for promulgation of realistic standards to assess the hazard to humans during fire. (Author's Abstract)

155. Goodman EI
TOXICITY OF NERVA REFLECTOR MATERIAL FOLLOWING A LAUNCH PAD ACCIDENT. Westinghouse Electric Corp, Astronuclear Lab; WANL TNR-070, 162 pages, Jul 1975
Availability: NTIS

Experimental and analytical work was performed to allow the source term for airborne beryllium to be estimated under the extreme conditions resulting from a launch pad fire. Graphs and tables are presented from which it is possible to evaluate the possibility of Be becoming airborne if the heat flux into the Be reflector and the duration of this flux are known. The experimental work consisted primarily of studying beryllium-flame reactions and beryllium-water reactions. The results indicate that beryllium can become airborne in a prolonged fire if surface temperatures in the neighborhood of the melting point (1283°C) are reached. Flame temperatures in excess of 2000°C were reached in the experimental work. Data on flame temperature in a launch fire and its duration are required before final conclusions can be drawn on the magnitude of the beryllium release, but present indications are that massive Be will not reach the threshold surface temperatures in a realistic incident. Although massive Be will not reach this condition, additional information should be reviewed as it becomes available on the fragmentation of the beryllium reflector since the quantity becoming airborne is quite sensitive to the beryllium area exposed and the surface to mass ratio. It is unlikely that the threshold Be surface temperatures reached in the laboratory are duplicated in an accident and it would take an extended period under these conditions to create an excessive downwind Be concentration. For the pessimistic Be release rate assumed it would take almost three hours (164 minutes) after reaching the threshold surface temperature to achieve 1% reflector release. In the study of the reactions of beryllium with water, the beryllium becoming airborne was negligible as compared with the flame reactions. (Author's Abstract)

156. King TY
SMOKE AND CARBON MONOXIDE FORMATION FROM MATERIALS TESTED IN THE SMOKE DENSITY CHAMBER. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-901, 41 pages, Oct 1975
Availability: NTIS PB-246 860/1GA

The effects of physical and chemical factors on the smoke and carbon monoxide generated by burning polymers and red oak in the NBS Smoke Density Chamber are reported. Smoke and carbon monoxide formation was found to depend on irradiance level and oxygen concentration in the chamber. Smoke optical density correlations with particulate mass density showed that the ratio of these two varied with material composition and burning conditions. (Author's Abstract)

157. Chien WP and Seader JD
SMOKE MEASUREMENT IN A MODIFIED NBS SMOKE-DENSITY CHAMBER. Univ of Utah, Flammability Res Center; FRC UU-44, UTEC 75-055, 211 pages, Apr 1975

An NBS Smoke-Density Chamber was used as the major apparatus in the study of smoke development from various natural and synthetic polymeric materials. The following new modifications were made to the NBS chamber: 1) installation of a force transducer unit under the sample holder for continuous measurement of sample weight, 2) modification of the original furnace to an automatically controlled high-energy-flux unit, and 3) conversion of the polychromatic optical signal to a monochromatic one. In addition, two techniques were developed to: 1) determine the concentration of smoke particulates, and 2) determine smoke particulate size.

By employing the above modifications and techniques, some important chemical and physical factors which affect smoke development were investigated. Simultaneous measurement of sample weight and light transmission led to the important concepts of mass optical density and particulate optical density. The effect of energy flux and modes of test (flaming and nonflaming) on the smoke generation behavior was found to be substantial. A study of the effect of fire retardant concentration on smoke generation from a rigid polyurethane foam revealed a complex relationship. The important physical parameters, either from a material or practical viewpoint, were established in the evaluation of the light obscuration hazard of smoke.

Transparent (nonabsorbing) liquid-type smoke from cellulosic materials was chosen for theoretical considerations involving light scattering phenomena. The smoke particulates concentration and particle sizes were determined by using the techniques developed in this work. The experimental results were shown to be in agreement with a single scattering model in the form of Bouguer's law within experimental error down to values of the optical transmission as low as 0.0000167 (corresponding to an optical depth of 11). (Author's Abstract)

158. Einhorn IN, Chatfield DA, Futrell JH, Mickelson RW, Voorhees KJ, Hileman FD and Ryan PW
METHODOLOGY FOR THE ANALYSIS OF COMBUSTION PRODUCTS. Univ of Utah, Flammability Res Center; FRC UU-49, 52 pages, 17 figs, 23 refs, Jun 1975

A detailed review is presented of the analytical methodology which has been developed in recent years to elucidate the mechanisms pertaining to the thermal decomposition of natural and synthetic materials. Special emphasis has been directed toward the advanced state-of-the-art analytical procedures utilizing computerized analytical systems required to separate, identify, and quantify components of complex mixtures of volatile gases, particulates, aerosols, and carbonaceous residues resulting from pyrolysis, oxidative degradation, and flaming combustion processes.

Further work is required to permit the continuous analysis of specific toxic products, such as hydrogen cyanide, which may be produced during thermal decomposition of many natural and synthetic materials.

An important problem is the analysis of aerosols and residues; this will likely require the development of new separation and analysis techniques such as interfacing a liquid chromatograph and mass spectrometer. The development of new methods for the in situ monitoring of combustion products in laboratory animals during actual exposure experiments will be an important area for future research. (Author's Abstract)

159. Powell EA, Cassanova RA, Bankston CP and Zinn BT
CHARACTERIZATION OF SMOKE PRODUCED BY BURNING POLYMERS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS; Paper No. 114
Combustion Symp, 2nd European; 1975, Sep, Orleans, France
Sponsor: European Section of the Combustion Inst, Orleans, France

Unique facilities have been developed for the determination of the properties of the smoke produced by burning polymeric materials under controlled conditions. These faciliites include an optical smoke analysis system using lasers which provides the capability to obtain in situ time histories of the mean particle diameter, refractive index, and volume concentration of the smoke particles. Data is presented for smoldering polyurethane and PVC plastics in air and oxygen-poor atmospheres. 6 pages, 3 figs, 5 refs (Author's Abstract)

e. PROTECTION AND MODIFICATION OF MATERIALS

160. Boylston EK and Muller LL
ELECTRON-MICROSCOPICAL OBSERVATIONS OF THE SOLUBILITIES OF FLAME-RESISTANT COTTON/POLYESTER BLENDS
Text Res J, 45(11):790-796, 1975

This report provides a framework for understanding the principles that are important in correlating small- and large-scale fires by describing a selected series of small-scale tests in terms of such fire concepts as ignition, propagation, heat release, and smoke generation. All of the methods have limitations and cannot completely evaluate fire performance, but they offer a baseline for continued development of tests to provide better correlations with real-fire performance. 13 figs, 4 refs. (Author)

161. Galil F
NEW TESTS FOR RANKING "SAFER" GARMENTS
Text Chem Color, 8(3):38-43, 1976

New test methods were developed to test and rank fabrics that fall between the categories of "normally flammable" and "self-extinguishing". The flammability characteristics of fabrics can be analyzed by using time lapse photography and a specially developed test for ease of extinguishment. The maximum flame area, rate of fabric destruction and maximum area destroyed were found to be useful parameters.

Cotton treated with different levels of a flame retardant finish was used to examine the test concepts. The test results, confirmed with garment testing on mannequins, indicate that fabrics which are not self-extinguishing can still be much "safer" garments and offer protection against severe injury, especially where defensive action by the wearer is to be expected. 10 figs, 3 tables, 4 refs. (Author)

162. Leonovich AA and Kiselev VF
COMBUSTIBILITY OF WOOD-FIBER BOARDS
Sb Tr VNII protivopozhar oborony, (5):3-15, 1974 (Russian)

The development of fire-resistant wood-fiber boards is reported. Fire resistance is achieved by using aqueous solutions of orthophosphoric acid, neutralized organic bases, urea and dicyandiamide in producing the boards. The results of testing specimens in a fire tube according to Standard 17088-71 are presented. (Author)

163. Vogt H
FIRE PROTECTION AGENTS FOR WOOD AND WOOD PRODUCTS
Dtsche Farben Z, 29(9):376-378, 1975 (German)

Wood is impregnated with phosphates, coated with a sodium silicate film or with suspensions which, when exposed to fire, liberate ammonia, water, CO(2) and phosphoric acid and form a viscous heat-insulating foam. A method of testing for combustibility by DIN 4102 is examined and the characteristics of fire-protection agents for wood are given.

164. Anon
FIRE PREVENTION RESEARCH CENTERS ON IMPROVING FLAME RESISTANCE OF POLYMERS
Rubber Age, 107(11):47, 1975

Scientists at the Brecksville, Ohio, research and development center of B. F. Goodrich Co. are working on new ways to prevent and control house fires by improving the fire resistance of polymeric materials. Materials under development are exposed to flames in a newly constructed flammability test facility that is large enough to simulate an actual fire situation in a typical room of the average American home.

The room-burn facility provides a realistic test situation for simulating residential fires. The facility is designed to aid development of materials with improved resistance to the effects of actual fire conditions. The facility also complements the smaller scale flame and smoke tests available to BFG researchers. (Author)

165. Kolganova MN
FIRE PROTECTION OF TEXTILE MATERIALS
Pozhar okhrana, 1:50-93, 1974 (Russian)

Modern methods of testing the flammability of textile materials are analyzed. Methods of imparting fire-proof properties to cellulose, synthetic and wool materials by impregnation with various compounds are outlined. The effectiveness and practical applicability of these methods are evaluated. Methods of producing synthetic materials with high thermal resistance are examined. 9 figs, 12 tables, 136 refs. (Author)

166. Anderson J
PROVIDING FLAME RESISTANT GENERAL APPAREL: AN ORDERLY APPROACH
J Consumer Prod Flammability, 3(1):10-20, 1976

On the basis of his experience as manager of apparel and textile testing of the JC Penney Co, the author proposes government and industry action to promote a voluntary non-binding flame resistant apparel standard that would be beneficial to industry and the consumer. It would benefit the consumer by permitting the involved industries to bring the benefits of available technology and competition to the retail counter more rapidly. 5 figs.

167. Shafizadeh F, Chin PS and DeGroot WF
MECHANISTIC EVALUATION OF FLAME RETARDANTS
J Fire Retard Chem, 2(3):195, 1975

Two different mechanisms are involved in flameproofing of cellulosic materials, controlling the pyrolytic reactions to produce char, water and carbon dioxide, instead of flammable volatiles, and preventing the combustion of the latter products in the gas phase. The effectiveness of flame retardants in controlling the pyrolytic reactions could be evaluated by TG, which measures the charring effect and by TEA, which measures the production of flammable volatiles. The TEA instrument could be also calibrated to provide the heat content of the combustible volatiles and this value could be compared with the heat of preignition to show the net energy produced or the combustibility of the substrate. This method has been used for evaluation of various flame retardants. (Author's Abstract)

168. Abbott NJ and Panto JS
NONFLAMMABLE FINISHES FOR USE IN FLIGHT CLOTHING. Air Force Systems Command, Aeronautical Systems Div; ASD TR-75-39, 69 pages, Dec 1975
Availability: NTIS

Nonflammable finishes were developed to improve the functional properties of fabric for flight clothing made from Nomex, Kynol, Kynol/Nomex blends and HT-4. Improvements in abrasion resistance, water repellency, electrostatic resistance, pilling and fuzzing resistance were obtained without adversely affecting flame and thermal resistance, breaking strength, tearing strength or moisture regain. (Author's Abstract)

169. Laub B, Chu E and Clark KJ
EXPLORATORY DEVELOPMENT OF HEAT RESISTANT AND NONFLAMMABLE FIBROUS MATERIALS. Aerotherm Acurex Corp, Aerotherm Div; Aerotherm 74-116, 78 pages, Feb 1975
Availability: NTIS CSCL 01/3

An analytical study was performed to evaluate potential improvements in thermal survivability of parachutes upon exposure to aircraft crash fires. Principal findings were that significant improvements in thermal survivability are achievable only through the use of advanced materials which, potentially, can provide survival into the flame zone. The investigation of possible design modifications indicated that alteration of fabric weight and optical properties can improve material thermal performance whereas alterations of fabric permeability are ineffective.

170. Lipska AE and Amaro AJ
DEVELOPMENT AND EVALUATION OF PRACTICAL AND SELF-HELP FIRE RETARDANTS. Stanford Res Inst; SRI Proj PYU-8150, 39 pages, Apr 1975

A study was conducted 1) to improve surface penetration of the retardant formulations for existing wood roofs and to evaluate the retardance efficiency of the resulting thermal hardening procedures, and 2) to investigate practical ways of incorporating retardants into nylon and dacron polyester (polyethylene terephthalate) carpets. Magnesium ammonium phosphate sprayed on and interstitially precipitated in existing wood roofs provides at least a Class C fire protection rating that should withstand weathering for at least five years. This self-help treatment is effective if the component chemical solutions are applied to roofs that are at least 5 years old. The depth of retardant penetration increases with the age of the roof, since exposure of the roof to the elements increases the porosity of the wood. The depth of retardant penetration in roofs much less than five years old is very shallow, resulting in only seasonal protection against firebrands.

The guidelines, derived from the Parker-Lipska arithmetical expression for choosing effective retardants, can be applied to cellulosics in general - be it paper, cotton, or wood. In addition, similar guidelines can be applied to those synthetics that are char formers and whose general mode of decomposition parallels that of cellulose. However, different guidelines remain to be developed for the nonchar-forming synthetics.

A 20% NH^4Br solution was applied to both the nylon and dacron polyester carpets and was found to prevent flame spread and to reduce the generation of toxic products. Although the chemical is water soluble, it is relatively inexpensive and can be easily applied with a rug shampooer once a year by the average citizen.

Although it is possible to permanently retard both the nylon and the dacron carpets, the procedure entails chemical incorporation of a retardant into the polymer chain itself, which, although potentially feasible during manufacture, would be impractical as a self-help remedy for the average citizen. (Author's Abstract)

f. STABILITY OF MATERIALS AT ELEVATED TEMPERATURES

171. Anon
FIRE RESISTANCE OF CONCRETE STRUCTURES
Inst of Structural Engineers; 59 pages, 1976

A full appreciation of ultimate limit states of concrete structures at normal temperatures is the essential prerequisite for being able to predict reliably their behavior in fire. Variations in strength of concrete and steel as well as those in Young's modulus, shrinkage, creep, and thermal coefficients must be considered in addition to such phenomena as spalling of concrete which are specifically related to fire.

Section one of the report presents facts and figures on current fires, statutory requirements of the designers and constructors and means of meeting these requirements.

Section two gives a detailed account drawn from national and international experience of the properties and behavior of materials at high temperature.

In section three the work of test laboratories in the fields of research on structures covering fire resistance of single elements and the effects of both continuity and restraint in the American and European laboratories is outlined. Section four develops the search for a rational and more truly representative method of structural design in fire.

Section five covers the broader aspects of design of concrete structures such as structural arrangements, choice of materials, firefighting considerations, and economics and education. Section six concludes with recommendations for the future in both the development of better techniques and the needs of further research.

172. Anon
FIRE RESISTANCE OF CONCRETE STRUCTURES
Fire Internat, 5(51):73-83, 1976 (English, French, German; Spanish abstract)

The fire performance characteristics of concrete structures is relatively very good owing partly to the ability of concrete to become more flexible under heating, together with the insulation of the heat-sensitive reinforcement by the concrete encasement. The principal parameters that affect the actual behavior of structural members in a real fire are type of structure and loading level, type of concrete and aggregate, type of reinforcement and quality of steel, shape and dimensions of the member, and concrete cover and other reinforcement protection. The presence or absence of these features is noted in five case fires selected for illustration. Fire tests in laboratories in relation to actual fires and the factors influencing the actual structure in real fires are discussed. The article is based on a report of a joint committee of the Institution of Structural Engineers and the Concrete Society published in London. 10 figs.

173. Salse E and Lin TD
STRUCTURAL FIRE RESISTANCE OF CONCRETE
ASCE Proc. J Struct Div, 102(ST1):51-63, 1976

A method is presented for calculating the structural fire endurance of concrete members under various conditions of axial and bending restraints. Included is the calculated temperature distribution during a fire within concrete sections. Practical illustrative examples are given. Conclusions were: 1) Temperature distributions can be calculated for various cross sections and aggregate types, and from these data and information on temperature-strength relations, the material strength can be obtained at any time during a fire: 2) equilibrium conditions at collapse, considering bending and axial restraint simultaneously, were obtained and show that time of collapse depends on the axial restraining force, its line of action, and member deflections; 3) axial restraining forces increase fire resistance; 4) for interior bays, fire resistance is independent of the restraining force location; 5) equilibrium conditions are independent of deflections whenever axial restraining forces are neglected; and 6) members in concrete structures can develop substantial restraining forces.

174. Olimpiev VG and Zenkov NI
STUDY OF THE THERMAL EXPANSION OF REINFORCING STEEL UNDER FIRE CONDITIONS
Sb Tr VNII protivopozhar oborony, (2):92-100, 1974 (Russian)

A method of testing reinforcing steel and test results are presented. A relation is given for calculating the average values of the thermal expansion coefficient of various reinforcing steels.

175. Iding R, Lee J and Bresler B
BEHAVIOR OF REINFORCED CONCRETE UNDER VARIABLE ELEVATED TEMPERATURES. Univ of California (Berkeley), Fire Res Group; UCB FRG 75-8, 70 pages, 33 figs, 2 tables, 6 refs, Apr 1975
Availability: NTIS PB-242 441/AS

Results of a pilot study on the behavior of reinforced concrete exposed to elevated temperatures are reported. A series of experiments was conducted in which the thermal and structural responses of unreinforced and reinforced concrete prisms to various combinations of heating and axial compression loading cycles were measured. Exposures of up to 600°F (316°C) were studied using equipment developed for this experimental program. Recently developed computer programs were utilized to simulate the experiments mathematically; these numerical solutions and the results of the experimental program are compared. Of particular interest was the validity of the mathematical models used in the computer programs to represent heat conduction and concrete cracking and crack closing due to thermal effects and axial compression.

176. Bijlaard F, Twilt L and Witteveen J
ON THE STABILITY OF FIRE EXPOSED STEEL BEAMS. Inst TNO for Building Materials and Building Structures (Netherlands); BI-76-7, 13 pages, 22 figs, 5 tables, 3 refs, 1976

A theoretical analysis is made of the stability of fire-exposed steel frames under the conditions: 1) the high-temperature behavior of the material is assumed to be nonlinearly elastic; 2) the temperature distribution is uniform; and 3) the effect of thermal expansion on the moment distribution is neglected. The first condition is essential for application. The general features of the program are discussed and the computer program was verified by comparison of results with experimental data of fire tests on simply supported small-scale steel beams and frames. The comparison reveals that the theoretically determined initial temperatures are in all cases underestimations of the experimental temperatures. The maximum deviation is about 100°C, the minimum about 25°C. Considering the uncertainties inherent in the fire process proper, this accuracy is considered to be adequate for practical cases. (Author)

177. Arnault P, Ehm H and Kruppa J
FIRE RESISTANCE OF COMPOSITE BEAMS (ISOSTATIC AND HYPERSTATIC). Centre Technique Industriel de la Construction Metallique (France); Doc No 2.10.20-4, 23 pages, 52 figs, 9 tables, 10 refs, Feb 1976 (French)

Under ordinary conditions of use, a steel beam with affixed slab, without any protection, remains fire resistant for about 30 min, the reference base being a collapse criterion at a certain infinite deformation rate. Protection of the upper flange or the addition of longitudinal reinforcement lead to an increase in fire resistance. Continuous girders have stability times very close to those obtained with isostatic beams. But to understand the rupture of steel beams in some tests, it must be emphasized that Mueller explains this phenomenon as incompatibility between the deformation capacity of the plastic knuckle which forms on the support and the curvature of the beam under the effect of the thermal stresses due to the temperature gradient in the thickness of the slab. If the knuckle cannot be adequately deformed, a considerable increase in moment on the support occurs, resulting in rupture of the steel at the cap. Tests carried out on continuous concrete slabs have shown that caps of soft steel anchored in the slab may be suitable. (Author)

178. Arnault P, Ehm H and Kruppa J
FIRE RESISTANCE OF HYPERSTATIC STEEL SYSTEMS (BEAMS AND RIDERS). Centre Technique Industriel de la Construction Metallique (France); Doc CECM 3-74/6F, 59 pages, 70 figs, 16 tables, 4 refs, May 1974 (French)

The tests confirmed the influence of the degree of exploitation on the critical temperature. A decrease in the ratio P/Pr leads to an increase in the critical temperature of structural systems. But this factor alone does not determine the stability of frames; the beam end conditions must also be studied. For the same value of P/Pr the critical temperature varies according to whether the beam is isostatic, continuous on three supports, or semi-embedded. Tests with a traction gauge showed the effect of conditions at the ends of beams; high critical temperatures were recorded (about 900°C with the 1/10 criterion). No effort was made to prevent beam expansion. For other hyperstatic systems the rupture temperature is about 750°C. The idea that all metal structures collapse at 550°C is incorrect; this is only the critical temperature of an isostatic beam working at a maximum constraint of 16 kg/mm². A high dispersion of beam temperatures was noted, as much as 200-300°C. The temperature of the adjacent zones of the supports is lower. (Author)

179. Arnault P, Ehm H and Kruppa J
FIRE RESISTANCE OF ISOSTATIC STEEL BEAMS. Centre Technique Industriel de la Construction Metallique (France); Doc CECM 3-74/2F, 46 pages, 30 figs, 7 tables, 7 refs, Mar 1974 (French)

Study of the fire behavior of isostatic steel beams has made it possible to better understand the influence of certain little known, sometimes ignored, parameters. The most important results concern the influence of the massivity of the components and their degree of exploitation. In order to satisfy a required stability, it is as important to take into account the beam shape and the maximum utilization limits as the nature of the protection. Unloaded beam heating tests under various heat programs showed that greater emphasis must be placed on real fires for a determination of the stability required for frames. Numerical calculations of steel beam heating yielded better understanding of the existence of different stabilities for like components in different fire chambers. A computational example of fire resistance of our isostatic beam is given in the appendix. (Author)

4. FIRE MODELING AND TEST BURNS

a. FIELD EVALUATION

180. Mousset P, LeDiraison J-C and Foltier C
LIQUID-GAS FIRE TESTS: RADIATION MEASUREMENTS AND SUPPRESSION TECHNIQUES
Congres du Gas (Gas Congress), 92-nd; 1975, 16-19 Sep, La Baule, France
Sponsor: Gaz de France (French)

Fifteen years of investigation by Gaz de France in collaboration with the Direction des Etudes et Techniques Nouvelles have resulted in prevention measures to avoid the accidental spread of liquid-gas spills and intervention techniques either to prevent ignition or to suppress the fire and protect adjacent installations. Among the techniques was the generation of low-water-content foams to flood liquid-gas spill areas before or after ignition. Satisfactory results have been achieved with expansion ratios of 250-1000. Appreciable reduction of the flame intensity in a few minutes after application of the foam permits the use of a so-called compatible foam (a powder that does not destroy the foam) to extinguish the fire. Adjacent installations can be protected by water curtains at flow rates commensurate with the radiation energy. A computer program makes it possible to determine the intensity of the radiation at various points.

181. Budnick EK and Klein DP
EVALUATION OF THE FIRE HAZARD IN A MOBILE HOME RESULTING FROM AN IGNITION. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-788, 26 pages, Feb 1976
Availability: NTIS PB-250 843/0GA

A series of fire tests was conducted in a typical mobile home to evaluate the potential fire hazard resulting from an accidental ignition from cooking on the kitchen range. Specific attention was directed to (a) ease of ignition of the kitchen cabinets as a function of the clearance between the range and the underside of the cabinets with and without the presence of a metal hood and (b) flame spread following the ignition. The tests, which used a preheated pan of cooking oil as an ignition source, were conducted in a mobile home kitchen area. The materials tested were printed lauan plywood, printed particle board, and molded polystyrene, representative of materials used in kitchen cabinet construction in mobile homes. (Author)

182. Hill R and Johnson GR
INVESTIGATION OF AIRCRAFT FUEL TANK EXPLOSIONS AND NITROGEN INERTING REQUIREMENTS DURING GROUND FIRES. Nat Aviation Facilities Experim Center; FAA NA-75-25, FAA RD-75-119, 84 pages, Oct 1975
Availability: NTIS AD-A021 665/5GA

Nitrogen inerting was investigated as a means of preventing or minimizing explosions and/or reactions in aircraft fuel tanks under simulated crash-fire conditions. Tests were conducted on both small and large volume tanks, inerted to various concentrations (expressed in terms of O2 concentration by volume), containing different amounts of Jet-A or JP-4 fuel and heated at different rates. Results of these tests indicated that internal fire or explosion would not result from external heating or internal high-energy spark when the tank was inerted to an oxygen concentration lower than 10 percent. (Author)

183. Braun E
REPORT OF FIRE TEST ON AN AM GENERAL METRO BUS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-718, 21 pages, Jun 1975
Availability: NTIS COM 75-10750

The center for Fire Res at the Nat Bureau of Standards has conducted a study of the fire safety of a bus supplied by the Washington, DC Metropolitan Transit Authority. The objectives of the work were: 1) to determine the minimum ignition from source necessary to initiate a fire in the bus, and 2) to determine the means by which a fire, once started, is most likely to grow and spread.

A series of small-scale laboratory tests were run in addition to the three full-scale tests. Tests showed that accidental ignition by a cigarette or dropped match is unlikely. However, the seat can be ignited with one or two matches, if applied at the proper location, as by an arsonist. In full-scale tests, ignition of the seat occurs readily with the following ignition sources: 1) a small bag of paper trash on the seat, 2) a newspaper under the seat, 3) if the contents of a can of lighter fluid is poured on the seat.

Fire growth and spread in the bus is primarily through involvement of the seat cushioning. Fire spreads from seat to seat with little direct involvement of other interior materials. In all three tests, between one and two minutes after the urethane ignited, dense smoke filled the bus space, seriously reducing visibility. Spread of fire beyond the seat of origin is not necessary for the level of smoke to be formed.

184. Wiersma SJ
CHARACTERISTICS OF FIRES IN STRUCTURAL DEBRIS. Stanford Res Inst; 59 pages, Jan 1975
Availability: NTIS AD-A018 798/9GA

Results of an experimental study of fire behavior in structural debris are reported. The study was conducted in two phases - the first in the laboratory, the second, involving large-scale burns, in the field. In both phases, debris-fire behavior was observed, rates of fire spread, durations of active flaming (i.e. residence time), and concentrations of gas effluents were measured, and the dependence of the observed and measured debris-fire characteristics on wind speed and on variables in debris composition were investigated.

185. Kourtides DA, Parker JA and Hilado CJ, et al
FIRE SAFETY EVALUATION OF AIRCRAFT LAVATORY AND CARGO COMPARTMENTS. Nat Aeronautics and Space Admin, Ames Res Center; NASA TM-X-62471, 56 pages, Aug 1975
Availability: NTIS CSCL 01C

Large-scale aircraft lavatory and cargo compartment fire tests are described. Tests were conducted to evaluate the effectiveness of these compartments to contain fire and smoke. Two tests were conducted: Test 1 involved a production Boeing 747 lavatory of the latest design installed in an enclosure outside the aircraft, to collect gases and expose animals to these gases. Results indicate that the interior of the lavatory was completely burned, evolving smoke and combustion products in the enclosure; Test 2 involved a simulated Douglas DC-10 cargo compartment retrofitted with standard fiberglass liner. The fire caused excessive damage to the liner and burned through the ceiling in two areas. Test objectives, methods, materials, and results are presented and discussed. (Author's Abstract)

186. Taylor AJ and Hards DJ
ENGULFMENT FIRE TESTS ON ROAD TANKER SECTIONS. Royal Armament Res and Development Estab, Fort Halstead (UK); RARDE 7/75, 32 pages, Jul 1975
Availability: NTIS AD-A017 447/4GA

Steel, aluminum and glass reinforced plastic (GRP) road tanks, each containing 3400 litres (750 gallons) of naphtha, were tested in a fierce engulfment fire. After 4 minutes the naphtha in the metal tanks was boiling and had become involved in the external fire which grew in size and vigor. After 5 minutes these experiments had to be terminated. The tank constructed from GRP was tested for the duration of the engulfment fire, i.e. 15 to 16 minutes. Although the tank was damaged, the contents did not become involved in the external fire. The tests were limited to fire engulfment and provide no evidence on other aspects of the comparison between GRP and metal tanks.

187. Fang JB and Scott JT
HEAT TRANSFER IN FURNACES FOR CIB COOPERATIVE PROGRAM AND HEAT BALANCE ANALYSIS OF WALL FURNACE. Nat Bureau of Standards, Inst for Applied Technol; NBSIR 75-794, 48 pages, Nov 1975
Availability: NTIS PB-247 203/3GA

Tests were conducted in the NBS wall panel furnace as part of a CIB international coperative program to measure and compare heat transfer in fire endurance furnaces. Additionally, a heat balance analysis showed that a cellular concrete block wall specimen absorbed more heat by convection than by radiation. The rate of radiant heat transfer was found to decrease slowly, while the furnace exhaust heat loss increased during the test from 42 to 58 percent of the heat output. The calculated radiant heat flux incident at furnace walls was found to be somewhat lower than the experimental value measured at the test wall.

188. DeCicco PR
FULL-SCALE FIRE TESTS ON ROW-FRAME RESIDENTIAL BUILDINGS
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 60-69
Sponsor: Armstrong Cork Co

A series of 24 full-scale fire tests were conducted in the Bushwick Section of Brooklyn in 1974. Four 3-story, attached, frame dwellings were used for the tests to document the behavior of a number of fires common to the area and to examine possibilities for improving fire safety in such buildings. The selection and planning of these tests were based upon a 2-year study of approximately 18,000 alarm records for this community of about 130,000 persons. 1 fig. (Author)

189. Stickney CW
INTERDEPENDENCY OF FULL-SCALE FIRE TESTING AND FIRE-CAUSE INVESTIGATION
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 19-24
Sponsor: Armstrong Cork Co

Various factors now emphasize that in the overall picture of fire protection, most particularly in structural fire and life safety, two of the biggest gaps result from the inadequacy or complete lack of information from the action-research type of fire testing and from comprehensive fire-cause investigations.

It has also become increasingly clear that these inadequacies in large part have resulted from a failure to recognize the interdependency of these two essential activities to provide needed focus and direction, each to the other; to provide a more effective means of developing comprehensive fire-cause information and then utilizing this more meaningful cause information to provide further refinement of fire test standards and procedures, and to provide greater weight to test results in the promulgation of structural-fire and life-safety standards. (Author)

b. FIRE TESTING, STRUCTURES

190. Abrams MS
FIRE TESTS OF HOLLOW-CORE SPECIMENS WITH AND WITHOUT ROOF INSULATION
J Prestr Concr Inst, 21(1):40-49, 1976

Fire tests were conducted on 8 in. hollow-core specimens 40 x 48 in. in plan. Specimens were tested with and without roof insulation to determine the effect of the insulation material on the temperature of the strand.

Specimens were oriented horizontally with the central 33 x 33 in. area of the underside of each specimen exposed to fire. No load was applied. Strand temperatures were monitored for more than 3 hours.

Test results indicate that strand temperatures were not significantly affected by the presence of the roof insulation. 3 figs, 5 tables, 3 refs. (Author)

191. Anon
INTERNATIONAL WORK IN FIRE TESTS FOR BUILDING MATERIALS AND STRUCTURES
Fire Prot Rev, 39(427):267,269-270, 1976

Significaint developments in fire protection measures are being achieved by continuing and increasing international cooperation in research work and in the preparation of international standards and codes of practice. The standardization work of committees and conferences of ISO (International Organization for Standardization), CEN (Comite Europeen de Coordination des Normes), and the BSI (British Standards Institution) as well as the 1975 Commission 14 Symposium of CIB (Conseil International du Batiment) on the control of smoke movement in building fires is cited in evidence.

192. Rumberg E
FIRE-BEHAVIOR TESTS OF FLOOR COVERINGS
VFDB Z, 25(2):55-56, 1976 (German)

This paper contains the summary of a literature evaluation of developments in testing techniques for the fire behavior of floor coverings during the last few years, especially in the USA. The aim of the evaluation was to obtain supportive information for the establishment of "Guidelines for Structural Fire Protection" and for part 1 of Standard DIN 4102 insofar as the fire behavior of floor coverings are concerned. 3 refs. (Author)

193. Winer A
PASSIVE FIRE PROTECTION FOR ALUMINUM STRUCTURES
Nav Eng J, 87(6):59-66, 1975

This paper describes a small-scale fire endurance test program sponsored by the Naval Sea Systems Command to screen candidate thermal insulation systems for passive fire protection of aluminum structures.

An incombustible thermal insulation system tested in 1 3/4 inch thickness provided the same degree of fire protection as three inches of a more conventional insulation, mineral wool, at a savings in insulation weight of over sixty percent. 11 figs, 4 tables, 3 refs. (Author)

194. Malhotra HL
HARMONIZATION OF FIRE TESTS IN EUROPE FOR BUILDING COMPONENTS
Fire_Prev_Sci_Technol, (11):21-5, 1975

Discussions at EEC level have been started with the aim of harmonizing fire test methods and building regulations. Harmonization of test methods is likely to be the first aim; ISO standards will provide the technical base. ILDA scheme will provide an interim solution for the mutual acceptance of fire resistance test data. CIB, FIP and other international organizations will provide a base for the formulation of common regulations and design techniques for engineers, 6 figs. [Safety in Mines Abstracts]

195. Breden LH
FULL-SCALE CORRIDOR FIRE EXPERIMENT USING A GLASS FIBER CARPET. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-782, 33 pages, Dec 1975
Availability: NTIS PB-248 643/9GA

A corridor fire experiment was carried out using a glass fiber carpet. It was observed that with a fuel loading of 2.7 pounds per square foot of wood in an adjacent fire room, no propagation of the fire occurred down the corridor. The glass fiber carpet in the burn-room became discolored and there was a significant weight loss of the carpet directly in contact with the fire. The carpet did not produce significant levels of smoke and did not spread the fire into the corridor. (Author)

196. Kanury AM and Holve DJ
A THEORETICAL ANALYSIS OF THE ASTM E-119 STANDARD FIRE TEST OF BUILDING CONSTRUCTION AND MATERIALS. Stanford Res Inst; NBS GCR-75-50, 141 pages, Aug 1975
Availability: NTIS PB-247 939/2GA

This report describes a theoretical analysis of the ASTM E-119 Standard Fire Test. Both analytical and numerical analyses of the test are performed, indicating how various physical, chemical, and structural variables influence the fire endurance of a construction member. Walls, doors, floors and ceilings in heavy timber construction are considered, represented mathematically as 'slabs'. Wood, gypsum board, and composite wood-gypsum board 'slabs' are discussed. The effects of various fire exposure conditions on the endurance time are assessed. Radiant heat transfer is the dominant heat transfer mode and reradiation properties of the exposed material have a strong influence on the fire endurance time. Thus, the true measure of fire severity is given by the heat flux to the specimen, a function of both the furnace temperature and emissivity. (Author)

197. Breden LH and Meisters M
THE EFFECT OF SAMPLE ORIENTATION IN THE SMOKE DENSITY CHAMBER. Nat Bureau of Standards, Center for Fire Res; NBSIR 76-1030, 27 pages, 15 figs, 7 tables, 10 refs, May 1976
Availability: NTIS

Smoke measurements were compared for various materials in the vertical and horizontal positions. There appeared a significant difference for thermoplastic materials because of the melting away from the incident heat flux in the vertical position. The horizontal mode in addition allows one to relate the chemistry of polymeric materials to the amount of smoke production. Finally, smoke measurements are made of products containing various amounts of smoke suppressants. (Author)

198. Fisher RW and Smart PMT
RESULTS OF FIRE RESISTANCE TESTS ON ELEMENTS OF BUILDING CONSTRUCTION. Building Res Estab (UK), Fire Res Station; BRE G-(R6), 1975

Sponsored__fire-resistance__tests__on structural_elements, first published in 1960, was found to be of great value to architects and others concerned with design and construction of buildings. The first publication was issued in a format which devoted a full page to each investigation; it was intended to keep it up to date with supplementary data sheets, but a number of factors, principally the ever increasing commercial demands for tests of all descriptions, have prevented this being done.

However, with the collaboration of the Fire Protection Association, it has been possible to revise the publication completely - in a simpler format. This publication contains results of sponsored fire resistance tests on proprietary building constructions or materials undertaken at the Fire Res Station, Borehamwood, since 1950 up to the end of 1972 and contains nearly four times as many entries as the first publication.

The tests do not form a connected series since they were undertaken at the request of a number of different manufactureres, who have agreed to the inclusion of their results in this published form. All firms who have sponsored tests were invited to participate in this publication, and acceptance or rejection was their decision entirely. The results are given basically in the form in which they were first reported. In particular no attempt has been made to metricate dimensions. (Author's Abstract)

199. Alpert RL, Modak AT and Newman JS
THE THIRD FULL-SCALE BEDROOM FIRE TEST OF THE HOME FIRE PROJECT (JULY 30, 1975). VOL I. TEST DESCRIPTION AND EXPERIMENTAL DATA. Factory Mutual Res Corp; FMRC 21011.6, 201 pages, Oct 1975

A series of full-scale Bedroom Fire Tests (1973,4,5) has served as a focus of the joint Harvard-Factory Mutual Home Fire Project which seeks to minimize loss of life and property through the development of a better scientific understanding of fire ignition, growth and extinguishment. The program is being sponsored by the National Science Foundation and recently also by the National Fire Prevention and Control Admin.

The objectives of these Bedroom Fire Tests are: 1) to provide detailed measurements and scientific understanding of a typical and fully realistic hostile fire, 2) to determine the reproducibility of realistic full-scale room fire tests under optimum control of furnishings and ambient conditions, 3) to test proposed theoretical concepts for generalizing results to other rooms and fuel configurations, 4) to test new experimental measuring instruments (e.g. fan anemometers, bidirectional velocity probes, ray and wide angle radiometers, inexpensive heat flux gauges, smoke property and toxicity devices, etc), 5) to explore the extensive use of photography for revealing the detailed mechanisms of fire development, and finally 6) to test sprinkler parameters (water flow, pressure, orifice size) designed specifically for residential occupancies.

This report contains: 1) a detailed description of the test setup and instrumentation, 2) a preliminary comparison with the Second Bedroom Fire Test ('74), 3) a complete tabulation of all data, in engineering units, obtained from all the 178 installed transducers as well as pre- and post-test measurements, 4) a critical evaluation of all questionable data, and 5) a detailed chronology of the fire development taken from on site observations and photographic records. Not included here, but readily available, is a large body of source material from the 1975 fire, such as movies, slides, prints, videotapes and IBM compatible computer tapes. The analysis of these results will be reported in Volume II, to be issued about June 1976. (Author's Abstract)

200. Corlett RC
MODELING OF SHIPBOARD FIRE SUPPRESSION, ANNUAL REPORT, 1 JUL 73 - 30 JUN 74. Univ of Washington, Dept of Mechanical Eng, 28 pages, Jun 1975
Availability: NTIS AD-A011 373, CSCL 13/12

Further smoke production measurements are reported. Smoke production per unit mass is deduced on the basis of exhaust stream CO^2 concentration data. A matrix of fire suppression tests with water spray and CO^2 has been carried out in the 6x6x6 ft fire enclosure and in a 2x2x2 ft scale model enclosure. A simple correlation indicative of a concise scaling rule was not expected and, in fact, did not result. But the data do constitute a basis for evolution of an empirically adjusted rational model whose intended application is extension of small scale or otherwise inexpensive test data to larger scale or relatively expensive situations.

201. Benjamin IA
PROSPECTS FOR A COMPARTMENT FIRE TEST; Paper No. 16
Fire Standards and Safety Symp, Final

4. FIRE MODELING AND TEST BURNS
b. Fire Testing, Structures

Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

This paper discusses fire tests and recently raised questions on their relevance for predicting the fire hazards associated with newly introduced materials and construction methods. A brief review of certain compartment burn-out tests is presented, and it is illustrated that the experimental findings are quite largely influenced by the size and location of the igniting source. Because of these observations, there is at present significant interest in development of testing procedures which simulate full-scale fires. Corner and compartment burns are discussed and mention is made of a recently proposed ASTM Committee E 39 draft of a Recommended Practice for Room Fire Tests. It is suggested that such tests can serve two purposes: first as a fire test method for qualifying products with regard to fire safety and, second, as a means for validating the use of smaller scale laboratory fire test methods. (Author's Abstract)

202. Boyd H
CONDITIONS FOR FULL-SCALE FIRE TESTING
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 24-38
Sponsor: Armstrong Cork Co

The need for closer correlation between tests and field installation is important. Tests may have to be carried out with a number of variables, since fire conditions in the field are not static. There is greater need for the designer and constructor to understand the test method and the objective of the test, for educational programs for all who are required to use, interpret, and enforce the present codes, and for uniformity in codes. Ways are suggested for the correlation of tests with field installations. 23 figs, 5 refs. (Author)

203. Parker WJ
THE LARGE-SCALE FIRE-TEST FACILITY AT THE NATIONAL BUREAU OF STANDARDS
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 45-48
Sponsor: Armstrong Cork Co

The newly completed fire-test facility at the Gaithersburg site of the National Bureau of Standards provides the capability of studying the fire endurance of columns, walls, and floor/ceiling assemblies, fire growth and control in rooms, fire spread and control in corridors, and smoke movement in buildings. The study of fire growth in a room is concentrated on the role of the furnishings, as well as the interior finishing materials. A burn room is also available to examine the fire-buildup process in a large item of furniture. (Author)

204. Croce PA
THE FULL-SCALE FIRE TESTS OF THE HOME FIRE PROJECT
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 49-60
Sponsor: Armstrong Cork Co

The goal of this work was to observe and analyze, in a realistic-home setting, fire development through the flashover phenomenon for the purpose of guiding several basic laboratory studies. For the first test, a full-scale bedroom facility was selected and furnished in typical fashion with a resulting fuel load of 3.8 lb/sq ft of floor area. A simulated-match ignition of the mattress was used to start the fire; ventilation was provided through a single open doorway. Measurements made during the burn included gas and solid-surface temperatures, total heat fluxes, gas velocities, gas-species concentrations, smoke obscuration, and radiative flux. Flashover occurred approximately 17 min after ignition.

For the second test, a similar facility was utilized, but instrumentation, reflecting the insight gained from the first test, was far more extensive. As in the first test, the fire grew slowly as the mattress became more involved; then, however, it spread rapidly throughout the room with flashover occurring at approximately 7 min after ignition. The data from this test have not yet been fully analyzed. 12 figs, 2 tables. (Author)

205. Walsh MP Jr
THE BUILDING OFFICIAL AND FIRE TESTING
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 89-95
Sponsor: Armstrong Cork Co

A building official with fire-protection engineering and fire-marshal background comments on large- and small-scale fire and safety testing with relation to building codes. Observations are made on: legal basis, appeals boards, and current thrusts of codes, tests significance to officials and users, problems with existing procedures, views on the importance of human factors, administrative techniques, field inspection, consumer protection, feedback from the field, systems, and personal experiences, need for reproducibility, and need for very-large-scale tests. (Author)

206. Cotton PE
THE PHILOSOPHY OF LARGE-SCALE TESTING
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA, pages 70-76
Sponsor: Armstrong Cork Co

A brief background of Factory Mutual's involvement in fire research, particularly large-scale testing, is given. Despite the cost, large-scale testing is necessary to solve many of the problems because of deficiencies in fundamental knowledge and analytical procedures needed to make valid predictions from such knowledge. Examples are given of large-scale testing of both industrial-occupancy protection and building-material fire behavior with explanations of the criteria used to evaluate the results. Parallel activities are also in progress attempting to reduce the size of the test arrays and at the same time maintain the ability to arrive at valid conclusions. Finally, a few examples of recent progress in basic fire research in modeling and the development of analytical techniques are discussed. 5 figs. (Author)

c. MODELING AND SCALING

207. Rinsen M
STATISTICS OF FLAMEPROOF TESTS AND FIRE RESISTANCE TESTS, ETC, IN 1973
Rep Fire Sci Lab (Japan), (11):81-3, 1974 (Japanese)

Statistical data are presented to classify and characterize the results of various fire tests carried out in 1973 by the different laboratories of the Res Inst of Fire Technology and Fire-Fighting Methods (Tokyo). The tests were carried out on laboratory models and under realistic fire simulation conditions for various items. Among the latter were different kinds of fire-hazard equipment in order to develop methods of protection in the case of earthquakes and local seismic disturbances. Tests of the combustibility and fire stability of various materials and structures used in industry, construction, and in the domestic area were conducted. Studies were made of the effects of temperature and fire on the performance of electrical insulation, electrical devices and other assemblies used in the electrotechnical industry. The number of experiments conducted for each type of test is given. The number of experiments and tests that yielded concrete results useful in evaluating the quality of the material, component or parameter being tested is given separately. 8 tables.

208. Werthenbach HG
TANK FIRES AS A CONTROL PROCESS
Chem-Ing-Tech, 47(16):683, 1975 (German)

A theoretical model of a tank fire was used (in conjunction with actual tests on tanks up to 2 m diameter and 2 m height) to determine the process by which such fires proceed.

209. Burros RH
PROBABILITY OF FAILURE OF BUILDING FROM FIRE
ASCE Proc. J Struct Div, 101(ST9):1947-60, 1975

The random generation of a small fire in a building, and its random growth into a large fire which consumes the combustible components of a compartment are described by a new, unified stochastic model, based upon the theory of the Poisson process. This model assumes unequal compartments and heterogeneity of risk of fire among them. The random failure of the building from fire is then described by a stochastic model based upon both the fire generation model and the lognormal distribution. The second mathematical model improves upon its predecessors by avoiding the underestimation of the probability of failure from fire for fixed nonstructural parameters. (Author's Abstract)

210. Parker WJ and Lee BT
A SMALL-SCALE ENCLOSURE FOR CHARACTERIZING THE FIRE BUILDUP POTENTIAL OF A ROOM.
Nat Bureau of Standards, Center for Fire

Res; NBSIR 75-710, 24 pages, Jun 1975
Availability: NTIS

An enclosure with a high ceiling was used to model some fires in a burnout room. Temperatures, oxygen concentrations, air velocity, and conductive and radiative heat fluxes were measured. The highest average air temperature in the upper part of the room was taken as a measure of the fire buildup potential of the room. Upper air temperatures attained in the model were similar in most cases to those in the full-scale compartment. From energy balance considerations this air temperature was related to the oxygen depletion in the room and was shown to correlate well with the oxygen content of the combustion gas and air exhausting from the model and full-scale room fires. (Author)

211. Schalit L, Schneyer G, Toor J and Laird D
DEVELOPMENT OF ANALYTICAL FIRE MODELS. Systems Sci and Software, La Jolla, CA; SSS R-74-2436, FPA OPD-75-53, 66 pages, Oct 1974
Availability: NTIS PB-250 731/7GA

This report describes the progress from June 17, 1974 to September 16, 1974, in a project to develop analytic models of pool fires and torch fires. (Author)

212. Twilt L
ORIENTATIONAL MODEL SCALE TESTS ON THE BEHAVIOUR OF FIRE EXPOSED SIMPLY SUPPORTED STEEL AND CONCRETE BEAMS. Inst TNO for Building Materials and Building Structures (Netherlands); BI-75-91, 19 pages, 16 figs, 2 tables, 7 refs, Mar 1976

Four model tests were performed on small-scale, simply supported beams to study the structural behavior of fire-exposed steel and concrete composite beams. The aim was to gather guideline information on possible failure modes and on the parameters governing failure. A simplified theoretical approach to describe the failure resulting from loss of moment capacity appeared to be in good agreement with experimental results. This approach may be applicable if failure is caused by shear of the connectors. If the connection between the steel and concrete is formed by rigid shear connectors, no theoretical approach is possible. (Author)

213. Wiersma SJ and Martin SB
THE NUCLEAR FIRE THREAT TO URBAN AREAS. Stanford Res Inst; 90 pages, Apr 1975
Availability: NTIS AD-A018 342/6GA

The nuclear fire threat to urban areas was evaluated in a five-year structural fire dynamics program. The program (1) experimentally determined the dynamic characteristics of full-scale building fires, and (2) used the findings of the structural fire behavior experiments along with existing knowledge of structural blast behavior to predict the combined blast-fire response of an urban area to a nuclear attack. In the experimental program, wood-frame buildings were burned to determine the dynamic behavior of one type of structure. Parameters which were varied included wind velocity, fuel contents in the rooms, degree of simulated blast damage to the building, number of buildings burning at one time, initial fire size, and ceiling material in the rooms. Measurements included burning rates, fire spread rates, toxic gas concentrations, air temperatures, and induced inflow winds. To predict the combined blast-fire response of an urban area to a nuclear attack, two land-use areas, residential and built-up commercial, and two ranges of overpressure, 2 to 5 psi and 5 to 15 psi, were considered. The predictions are summarized in a table. A striking result of the study is the uniform coverage of debris, leaving very few debris-free areas except in built-up commercial land-use area at the 2-5 psi overpressure range.

214. Golden JV, Lloyd JR and Novotny JL
DESIGN, CONSTRUCTION, AND EVALUATION OF A SMALL-SCALE FIRE RESEARCH WIND TUNNEL. Univ of Notre Dame, Dept of Aerospace and Mechanical Eng; TR-37191-74-5, 85 pages, 51 figs, 6 tables, 19 refs, Nov 1975
Availability: NTIS PB-242 236/AS

A small scale fire research facility has been designed and constructed to provide apparatus with which data could be obtained for the proposal and evaluation of basic models of radiation, turbulence, and combustion processes in fire situations. These models would be incorporated in the numerical study which is directed toward the development of a program to predict fire and smoke spread in corridors and other similar configurations. The facility was designed to be as versatile as possible in order to permit the geometrical configuration to be modified with a minimum of difficulty. The basic apparatus was a wind tunnel constructed such that its aspect ratios could be varied. One of the walls, which could be located in either the floor or the ceiling, was equipped with a narrow porous metal plate planning the width of the test section through which various fuels could be injected. Velocity and temperature probes were constructed to provide the appropriate profiles at various locations in the tunnel test section. The surface containing the porous plate was also instrumented with thermocouples to provide the surface temperature profiles. Mean velocity and temperature profiles were taken at various wind tunnel test section cross-sections to evaluate tunnel performance and operating characteristics. The tunnel was demonstrated to be capable of a wide range of free stream velocities (2 feet per second (0.61 m/sec) to 60 feet per second (18.3 m/sec)), and a two-dimensional flow field was shown to exist in the test section. Profiles of turbulent boundary layers with mass addition, with and without combustion, were compared qualitatively with similar experimental studies. (Author's Abstract)

215. Friedman R
BEHAVIOR OF FIRE IN COMPARTMENTS
Fire Safety of Combustible Materials Symp, 1st Internat; 1975, Oct 15-17, Edinburgh, Scotland
Sponsor: Univ of Edinburgh, Scotland

Compartment fires before and after flashover are described. A few references are provided to surveys on postflashover studies, and then preflashover behavior is discussed in detail. First, four examples of Factory Mutual fire studies are presented which illustrate dramatic interactions of a fire with the surrounding compartment, involving 1) radiant interchange, 2) oxygen starvation, 3) excessive ventilation by heat and smoke vents. Then, the mechanism of flashover is discussed, and the concept of a critical heat flux level as a criterion is reviewed. Other relevant factors are mentioned. The "corner test" for flammable walls and/or ceiling is discussed. Some recent research dealing with buoyant motion of hot gases in a compartment are summarized. These include ceiling jet studies and gas movement in and out of an opening. Finally, modeling procedures for compartment fires are reviewed, including Froude modeling, pressure (Grashof) modeling, and B-number modeling. 14 pages, 2 figs, 3 tables (Author's Abstract)

216. McGarvey AR (Ed)
Full-Scale Fire Tests Symp, Proc, 1975; 1974, Nov 11-12, Lancaster, PA
Sponsor: Armstrong Cork Co

The goal of the symposium was to find a better way to predict the fire performance of products and systems in a real fire. Until the development of a more meaningful and better-defined relationship between small-scale tests and real fires, full-scale fire testing must be relied upon to assess the fire hazard of products and systems. The symposium was attended by about 60 researchers and building code officials, of whom 13 presented formal papers, which are abstracted separately. (Author)

d. SYSTEMS BEHAVIOR

217. Roux HJ
THE ROLE OF TESTS IN DEFINING FIRE HAZARD; Paper No. 9
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

Recent increased concern about life safety by various interested public agencies has led to questioning of the credibility of small-scale fire tests as a means to predict the performance of a product or system in a real fire situation. It is proposed that many of these fire test methods, but not all, can be upgraded to fire characteristic test methods, by the application of appropriate criteria. Furthermore, the results from one or more fire characteristics test methods, plus other parameters, could then be integrated to establish the potential for harm (PH) of a product or a system. The fire hazard of a product or system is only then established by combining the potential for harm with the degree of exposure.

One pragmatic approach to establishing the integration equation for the PH of a product or system is to start with the available fire statistics for that product or system; to prepare from these statistics a scenario or scenarios which describe the involvement of the product or system in a fire and its effect on the fire; and subsequently to write an integration equation which fits this scenario. Obviously, this approach would identify the fire characteristic test methods and parameters which are needed to assess the PH of that product or system. Included in this concept is the idea of using full-scale fire tests, either to prove the integration equation for a given product or system, or to assess directly the PH of that given product or system.

Alternately, full-scale fire tests can be used to derive the integration equation for a given product or system, in particular when there are no available fire statistics for that product or system. (Author's Abstract)

5. FIRE PROTECTION PRINCIPLES

a. BUILDING DESIGN AND CONSTRUCTION PRINCIPLES

218. Roytman MYa, Sobti MK (Translator) and Kuvshinoff BW (Translation Editor)
PRINCIPLES OF FIRE SAFETY STANDARDS FOR BUILDING CONSTRUCTION
Amerind Publ Co, Pvt Ltd, New Delhi, India; 429 pages, 1975

The results of scientific research conducted by planning and design organizations and agencies of the USSR State Fire Service for the development of basic fire prevention building codes have been generalized in this book, which was first published in the USSR in 1962 and was translated and published for the Nat Bureay of Standards, US Dept of Commerce. Approximate methods for calculating the actual and required fire resistance ratings of structures have been included, as well as methods for determining the cross sections of smoke and explosion vents and the structural designs of smoke shafts and blow-out panels. Design experience with fire barriers has been generalized also, and the necessary separation distances between buildings and other structures for the purpose of preventing fire spread are specified. Building design requirements for safe evacuation of people and methods for calculating permissible and actual evacuation times are described.

This book can be used by designers and architects, fire prevention officials, fire service trainees, and structural engineering students.

The book contains 85 tables, 177 illustrations, and 133 references.

219. Hagglund A
BUILDING DESIGN PRINCIPLES
Fire Prot Conf, Internat; 1975, Apr/May, Amsterdam, pages 5-12
Sponsor: Conf Fire Prot Assn Europe

A short review of a few characteristic fire case histories precedes a discussion of the design measures required to protect highrise buildings from fires, the design guideline being the concept of a building in which emergency evacuation is not practical and in which fires must be fought internally because of height. 3 figs, 3 tables, 17 refs.

220. Ivanov EN
CALCULATION OF THE WATER INPUT REQUIRED TO INCREASE THE FIRE RESISTANCE OF WATER-FILLED STEEL STRUCTURES
Sb Tr VNII protivopozhar oborony, (2): 149-67, 1974 (Russian)

By generalizing the existing studies and experimental fire tests of water-filled structures, a theoretical principle is found for their behavior when exposed to fire and a method of calculating the water input required for planning purposes is developed.

221. Erdelyi BJ
TEST RESULTS: DUCTED STAIRWELL PRESSURIZATION SYSTEM IN A HIGH-RISE BUILDING
ASHRAE J, 18(2):34-40, 1976

Most test and design data available today concentrate on a single entry fan system employed at the top or bottom of a shaft to pressurize a stairwell. In a building as described here it presents many design problems. To avoid the major difficulties, a system utilizing supply and exhaust ducts to distribute the air was designed and installed in an existing 50-story building. Covered are the design logic, construction considerations, cost, test results, and recommendations. (Author's Abstract)

222. Shaw CY and Tamura GT
DESIGN OF A STAIRSHAFT PRESSURIZATION SYSTEM FOR TALL BUILDINGS
ASHRAE J, 18(2):29-33, 1976

Pressurization by injecting outdoor air into a stairshaft is one means of maintaining tenable conditions in it during a fire emergency. Studies were made on various factors that govern performance of stairshaft-pressurization systems. Proposed here is a design for one such system. The performance of this system under various fire conditions was investigated using a computer model of the building. (Author's Abstract)

223. Polthier K
WATER-COOLED STEEL SUPPORTS IN HIGH-RISE CONSTRUCTION
Stahl Eisen, 95(7):312, 1975 (German)

The results of a research project for the development and application of water-cooled steel supports in high-rise buildings are reported in this communication. The project was carried out at the Federal Research Institute of West Germany. Concise technical data are presented.

224. Anon
STRUCTURAL PROTECTION TO CONTROL FIRE SPREAD
Fire Prot Rev, 39(423):69,71-72, 1976

Structural protection of buildings should be ensured in the project stage by architects, designers and builders to limit the spread of fire. The four structural aspects to be considered are: careful selection of building materials, compartmentation, segregation, and the protection of openings.

225. Bakenhus G
THE FIRE PROTECTION ELEVATOR
Brandschutz, 30(3):71-74, 1976 (German)

On the basis of regulations valid in the various states and guidelines, some of which have already been applied, the following minimum requirements for a fire protection elevator for highrises are proposed: separate fire-resistant shaft; access on every floor (ventilated chamber of sufficient size to take a stretcher); elevator cabin with dimensions 1 to 2.1 m, shaft door at least 0.80 m wide, emergency exit in the roof; emergency signal and cross-talk system; overriding communication from the ground floor; emergency power supply; and fire-resistant power supply cable to the elevator. 4 figs, 1 table.

b. DETECTION AND ALARM EQUIPMENT

226. Anon
EARLY WARNING AUTOMATIC FIRE DETECTION SYSTEMS
Fire Prot Rev, 39(426):210-211,213,214, 1976

Published information related to the choice of equipment for early warning automatic fire detection systems is reviewed. The essential requirements of such systems, i.e., reliable response to an incipient fire and unambiguous alarm signalling coupled with, ideally, false-alarm immunity and warning of the failure of components, are pointed out.

227. Anon
OXYGEN MONITORS
Nat Saf News, 111(4):91-3, 1975

Reviews the available types of direct and indirect reading instruments: coulometric oxygen detectors, paramagnetic oxygen analyzers, indirect-reading instruments, carbon dioxide monitors and polarographic detectors. 7 figs. [Safety in Mines Abstracts]

228. Wagner JP, Fookson A and May M
PERFORMANCE CHARACTERISTICS OF SEMICONDUCTOR SENSORS UNDER PYROLYTIC, FLAMING, AND SMOLDERING COMBUSTION CONDITIONS
J Fire Flammability, 7(1):71-103, 1976

Taguchi gas sensor (TGS) 109 is shown to be a suitable fire/gas sensor for use in metal and non-metal mines. Very good response to pyrolytic and smoldering combustion products of important mine fuels, insensitivity to two important ambient contaminants-water mists and rock dust clouds-are selected performance highlights. Good carbon monoxide response and relative insensitivity to hydrocarbons when TGS 109 is operated in the CO mode, i.e., at a heater voltage, V(h), equal to 0.8 volts, and resistance to "irreversible" sensor poisoning from HCl are also noted.

Lack of response of TGS 109 to flaming combustion from liquid and solid hydrocarbons in a test enclosure employing low fuel loadings (i.e. ratio of fuel weight to floor area of enclosure) is one drawback noted. False alarming problems for TGS 109 are also discussed.

Comparative performance data of TGS 109 versus conventional heat and smoke detectors for flaming and smoldering combustion sources are presented. The application of the TGS device to the residential detection problem is considered. The need for realistic test methods for evaluation of detector performance and further research study in the area are also pointed out. 17 figs, 5 tables, 14 refs. (Author's Abstract)

229. Anon
FAIL-SAFE SYSTEM
Instrum Technol, 22(10):55, 1975

A description and circuit diagram are given for a fire control system that monitors its own integrity, automatically signals any malfunction, and separately signals a fire in any zone being monitored.

230. Dimeff J
MODULATED HYDROGEN ION FLAME DETECTOR
US Patent No. 3,938,956, Cl 23-254, (G01N 27/62), Appl 28 Jun 75, Discl 17 Feb 76, Assignee: Nat Aeronautics and Space Admin

In a hydrogen flame detector there is provided a means for modulating the density of a gas stream prior to its introduction into the detector flame. A detector, responsive to the resulting modulation of the flame, is provided for producing an output signal having a component fluctuating at the frequency of modulation. A cross-correlator, responsive to the output signal and a signal at the frequency of modulation, is provided for producing a resultant signal proportional to the cross correlation between its two input signals. A means is further provided for recording or otherwise utilizing the resultant signal thus produced.

231. Lay D
A NEW CONCEPT FOR AUTOMATIC DETECTION AND EXTINCTION OF FIRES. Nat Bureau of Standards, Inst for Applied Technol; NBSIR 76-1028, 20 pages, Mar 1976
Availability: NTIS PB-251 415/6GA

The use of automatic fire detectors to trigger fire extinguishment systems has gone on for many years. Automatic extinguishing systems with practically an unlimited supply of agent suffer from the fact that these systems often continue in operation long after the fire is out, resulting in additional damage. This paper describes how such disadvantage can be avoided, to a large extent, with a modified design for permanently-installed, automatic extinguishing systems which will only discharge extinguishant at the proper time and in the proper amount.

Trans. of paper presented at the International Seminar on Problems in Automatic Fire Detection (7th), Aachen, Germany, on March 5-6, 1975. Prepared by Verband der Sachversicherer e.V., Cologne (West Germany). (Author)

232. Trumble TM
ULTRAVIOLET WAVELENGTH SMOKE DETECTOR. Dept of the Air Force; AD-D001 991/9, 16 pages, Oct 1975
Availability: NTIS PAT-APPL-621 338/GA

In the patent application collimated ultraviolet light radiation at wavelengths of 2537A and 3129A is alternately directed across the space to be monitored for smoke indicative of a fire. Particulate matter in the beam paths will affect the different wavelengths with different amounts of attenuation. The ratio of the attenuated beams is indicative of the size of the particulate matter in the beam paths. The invention provides a smoke/fire detector that operates at a level that will not injure human eyes. (Author)

233. Cohen J and Edelman J
POLYMERIC PYROELECTRIC SENSORS FOR FIRE PROTECTION. FINAL REPORT, JUN 1972-MAY 1973. Nat Bureau of Standards, Inst for Applied Technol; NBSIR 75-728, AFAPL TR-74-16, 34 pages, Jul 1975
Availability: NTIS AD-A014 830

This report summarizes the results of a program to develop optical radiation sensors for fire detection using polymeric pyroelectric sensing elements. Emphasis has been placed on techniques for constructing such devices, including methods of enhancing the pyroelectric response. Materials investigated included polyvinyl fluoride (PVF) and polyvinylidene fluoride (PVF2). Six sensors were developed and delivered to the sponsor. Highlights reported include achievement of a value of specific detectivity, D2 x 10^8 cm square root of Hz 1/w and the construction of a set of sensors useful over a wavelength range extending from the ultraviolet to the infrared. Methods of characterizing the performance of sensor elements are described. (Author)

234. Fox DG
DEVELOPMENT OF ELECTRICAL CIRCUITS FOR ADVANCED HIGH TEMPERATURE FIRE DETECTORS. Wright-Patterson AFB, OH, Air Force Aero Propulsion Lab; AFAPL TR-75-111, 42 pages, Mar 1976
Availability: NTIS AD-A023 843/6GA

This program was directed toward developing electronic circuits for advanced high temperature infrared and ultraviolet fire detectors which had been developed by the laboratory. A circuit which is applicable to any gas discharge type of UV sensor performed satisfactorily; however, the high temperature UV sensor did not perform reliably above 600F. A circuit for a 750F infrared fire detector was developed and performed satisfactorily. The circuit uses the flicker phenomenon of fuel type fires to distinguish the fire from background sources. This circuit is applicable to any similar solid state infrared sensor. (Author)

235. Bukowski RW and Bright RG
RESULTS OF FULL-SCALE FIRE TESTS WITH PHOTOELECTRIC SMOKE DETECTORS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-700, 57 pages, Jun 1975
Availability: NTIS

In February 1974, a series of full-scale fire tests were conducted to determine whether photoelectric-type smoke detectors could respond to the same types of fires used to assess the performance of ionization-type smoke detectors. In addition to the UL-167 standard fires, fires involving polyurethane (flaming mode) and cotton (smoldering mode) were added to the test series. One detector, utilizing a Taguchi gas sensor (TGS) was included in the test series for evaluation purposes. The test results indicated that the better photoelectric smoke detectors detect the same test fires as the ionization chamber smoke detectors in approximately the same time scale. For the smoldering cotton fire, the photoelectric detectors were significantly faster than the ionization chamber detectors. The TGS fire detector was unable to detect most of the test fires.

236. Schnell M
POINTS OF VIEW IN TESTING FLAME DETECTORS. Verband der Sachversicherer, e.v. (FRG); NBSIR 76-1040, 18 pages, 6 figs, 6 refs, May 1976
Availability: NTIS

The general principles for type testing the fire detectors which are already in use in the assessment of heat and smoke detectors are summarized. These include the so-called basic tests and the trial tests. The trial tests were intended to include all test fires in order to ensure comparability of tested fire detectors. Additional test fires are proposed which are intended to permit differentiated comparison of flame detectors between one another. The main problem in assessing the performance of flame detectors during environmental influences is the selection of a suitable radiation source for reproducibly simulating the characteristic "flame". The requirements that this radiation source must fulfill are dealt with and various realizations involved are discussed. The practical testing of infrared flame detectors to the basic tests is described. In addition, a suggested test apparatus for ultraviolet flame detectors is dealt with. (Author)

237. Byrd NR and Sheratte MB
SEMICONDUCTING POLYMERS FOR GAS DETECTION. McDonnell-Douglas Corp, Long Beach, CA; NASA CR-134885, 175 pages, Dec 1975
Availability: NTIS

Four conjugated polyenes, and two polyesters containing phthalocyanine in their backbone, were synthesized. These polymers were characterized by chemical analysis, thermogravimetric analysis, spectral analysis, and X-ray diffraction studies for crystallinity, as well as for their film-forming capability and gas/polymer interactions. Most of the polymers were relatively insensitive to water vapor up to 50 percent relative humidity, but the polyester/phthalocyanine (iron) polymer was relatively insensitive up to 100 percent RH. On the other hand, poly (p-dimethylaminophenylacetylene) was too conductive at 100 percent RH. Of the gases tested, the only ones that gave any evidence of interacting with the polymers were SO2, NOx, HCN and NH3. Poly(imidazole)/thiophene responded to each of these gases at all relative humidities, while the other polymers gave varying response, depending upon the RH. Thus, since most of these gases were electron-accepting, the electron-donating character of poly(imidazole)/thiophene substantiates the concept of electronegativity being the operating principle for interaction effects. Of the six polymers prepared, poly(imidazole)/thiophene first showed a very good response to smoldering cotton, but it later became non-responsive, presumably due to oxidation effects. However, poly(imidazole)/ferocene generally gave consistent responses. The other four did not. The reason for this is not known. (Author)

238. Gawin WM and Bright RG
MOBILE HOME SMOKE DETECTOR SITING STUDY. Nat Bureau of Standards, Center for Fire Res; NBSIR 76-1016,49 pages, 31 figs, 1 table, 4 refs, May 1976

An investigation was conducted to evaluate the sigificance of smoke detector locations to response time for a specific set of fire conditions in a mobile home. Parameters having the potential of affecting response time include: the physical location within a mobile home, such as inside wall vs outside wall or wall vs ceiling installations; the impact of air circulation resulting from the operation of the heating, ventilating, and air-conditioning system; and the basic detector parameters of smoke detector alarm threshold. For the study only photoelectric-type smoke detectors were used. These detectors utilize the Tyndall Effect in their sensing mechanism. This limitation was imposed to limit the number of variables. Detector response was evaluated for fires in both smoldering and flaming modes. The results of the study provide a case for wall installations as opposed to ceiling installations. Further, inside wall installations may be marginally superior to outside wall installations. The most significant finding of the study suggests that, when in operation, the forced-air circulating system has a major delaying effect on detector response time to a given fire size. (Author)

239. Fry JF and Eveleigh C
THE BEHAVIOUR OF AUTOMATIC FIRE DETECTION SYSTEMS. Building Res Estab (UK), Fire Res Station; BRE CP-32-75, 25 pages, Apr 1975

Fire Res Note 310, March 1970 describes an examination that has been made of the frequency and reasons for the occurrence of false calls made by automatic fire detection systems. These appear to be about 11 times as frequent as calls to genuine fires. About one quarter of false calls are attributed to ambient conditions, one half to mechanical and electrical problems and about 17 per cent to failure in or misuse of the communications systems. Where automatic systems are installed, about 68 per cent of calls to genuine fires are made by them. (Author's Abstract)

240. Wagner JP, Fookson A, Harper A, May M and Welker R
FIRE ALERT SYSTEMS FOR METAL AND NON-METAL MINES. Gillette Res Inst, 164 pages, Aug 1975; BuMines-OFR-45-76 Availability: NTIS PB-251 715/9GA

The details of a three-phase study (total time period of 12 months) entitled "Fire Alert Systems for Metal and Non-Metal Mines," are presented. Phase 1 consists of a state of the art survey on fire detection devices and gas sensing techniques. Phases 2 and 3 include laboratory screening and systems concepts testing on various detectors classified as products of combustion, optical view-field and contact (or thermal) types under incipient and flaming combustion conditions. Recommendations for a mine fire detection system to protect shaft, sealed off or mined out (from spontaneous combustion of sulfide containing ores and cellulosic materials), and fuel storage areas are also included.

The principal problem area noted during Phase 1 study is the high expected occurrence of false alarming of products of combustion detectors (POCs) subjected to normal mining operations - diesel vehicles and equipment and shot firing or blasting operations. Simultaneous gas sensing of either the ratio of CO/NO(x) or CO(2)/NO(x) with detection of one or more fire signatures (smoke, radiant energy, or heat sensing) is the recommended approach to discriminate against these operations. (Author's Abstract)

241. Hertzberg M and Litton CS
OPTIMAL DETECTION OF FIRES AND EXPLOSIONS: AN INFRARED SYSTEM FOR METHANE-AIR IGNITIONS. Bureau of Mines, Mining and Safety Res Center; BuMines RI-8035, 29 pages, May 1975
Availability: NTIS PB-242 624/5

The optical detection of fires and explosion is considered fundamentally. The measured spectral radiances from methane-air ignitions are compared with the background irradiances from stray and ambient sources, and with the spectral sensitivities of various sensors. The comparison naturally suggests the optimum spectral ranges and signal processing logic that can uniquely characterize the ignition event. Both ultraviolet and infrared systems are considered. Several alternate sensing methods are proposed and discussed. The development and testifire ng of an infrared system designed for use in ignition suppression devices in mines is described.

242. Dalverny LE, Fink ZJ and Weinheimer JP
CONTINUOUS GAS MONITORING USING TUBE BUNDLES AT THE JOANNE MINE FIRE. Bureau of Mines; BuMines TPR-92, 4 figs, 1975
Availability: NTIS

Describes the deployment, 5-month operation, and lessons gained from a continuous gas monitoring system using sampling-tube bundles at an underground mine fire in West Virginia. Res information gained indicates the utility of relating certain gas concentration ratios to events during fire development, mine reventilation, and mine recovery. In addition to monitoring the quality of remote fly ash seals, the system provided timely warning of dangerous gas concentrations which developed during surface and underground recovery activities. An evaluation of system components is supplemented by recommendations for improvements.

243. Bukowski RW, Waterman TE and Christian WJ
DETECTOR SENSITIVITY AND SITING REQUIREMENTS FOR DWELLINGS. IIT Res Inst, Eng Mechanics Div; IITRI J6340-FR, NBS GCR-75-51, 337 pages, 1975
Availability: NTIS PB-247 483/1GA

A test program was undertaken to investigate the operation of residential smoke detectors under actual field conditions. The main objectives were to determine: 1) minimum sensitivity, 2) best location and 3) escape time provided by a group of typical detectors. Instrumentation was used to determine theoretical response times of an 'ideal' detector as a base line for evaluation of detector performance. The tests were conducted using smouldering or flaming ignition of sofas, chairs and mattresses in various rooms in two abandoned, single-family houses scheduled for demolition. Work was carried out during winter and summer seasons with central heating and cooling on and off. (Author's Abstract)

244. Scheidweiler A
AN INTERFERENCE SIMULATOR FOR QUANTITATIVE DETERMINATION OF THE SUSCEPTIBILITY OF FLAME DETECTORS TO FALSE ALARM. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-956, 16 pages, Nov 1975
Availability: NTIS PB-247 654/7GA

All fire detectors are susceptible to false alarms, i.e. responding to fire-like conditions when no fire is present. Of all the known fire detectors, flame detectors are probably the most false alarm prone of any of the fire detectors, primarily because these detectors are subjected to more environmental influences resembling the detectors' operating mode than any other fire detector. This paper describes an investigation into the susceptibility of flame detectors to false alarms. The author describes a test apparatus, constructed and used by his firm to evaluate the susceptibility of currently available flame detectors to false alarms. In addition, the apparatus can be used to evaluate prototype flame detectors. (Author's Abstract)

245. Burry PE
CURRENT RESEARCH ON FIRE DETECTION AT THE FIRE RESEARCH STATION. Building Res Estab (UK), Fire Res Station; BRE CP-38-75, 7 pages, 4 figs, 6 refs, Apr 1975

This paper deals with work in progress at the Fire Res Station in the field of fire detection. Much of this work is aimed at keeping both British and Internat Standards abreast of developments in the building industry. As an example of the ways in which one piece of work can affect several different research projects, a description of the development of the separated ionisation chamber is given. (Author's Abstract)

246. Trumble TM
A SMOKE DETECTION SYSTEM FOR MANNED SPACECRAFT APPLICATIONS. Air Force Systems Command, Air Force Aero Propulsion Lab; AFAPL TR-74-97, 96 pages, Jan 1975
Availability: NTIS

It was the specific purpose of this effort to build a smoke detector which could monitor the open volume of a habitable compartment in a spacecraft. Since commercially available sensors could not accomplish this goal, nor be upgraded to do so, it became necessary to design a new system. Res into the nature of smoke, i.e. particle size and distribution, was undertaken. Literature surveys, both through commercial literature and libraries, were conducted. Construction and subsequent testing of a laboratory model spacecraft smoke detector were accomplished. (Author's Abstract)

247. Nash P and Young RA
THE PERFORMANCE OF THE SPRINKLER IN DETECTING FIRES. Building Res Estab (UK), Fire Res Station; BRE CP-29-75, 15 pages, 16 figs, 12 refs, Apr 1975

It is shown that the response of sprinklers to a fire situation does not only depend upon the sprinkler itself, but also upon many characteristics of the building and the fire-load concerned. A proper study of all the factors can greatly help in deciding the design parameters of a system in order to make it as effective as possible in a specific application. (Author's Abstract)

c. FIRE AND EXPLOSION RISKS

248. Heinsohn G
PURPOSE AND SIGNIFICANCE OF THE NEW GUIDELINES FOR THE AVOIDANCE OF THE HAZARDS OF AN EXPLOSIVE ATMOSPHERE
Amts Mitteilungsbl Bundesanst Materialpruef, 6(1):15-22, 1975 (German)

The Guidelines are compared with respect to content and practical implications with the previous (still valid) guidelines and other German sets of regulations relating to protection against explosion. It is shown that their implementation should result in a considerable improvement in the effectiveness of protection against explosion by introducing and explaining in detail primary measures of protection and by a thorough treatment of all the kinds of ignition sources to be avoided. This systematic presentation, achieved by systematizing the entire field of protection against explosion, makes it possible to execute plans for explosion protection even before constructing plants and to coordinate these plans with the production plans. Additional operational and economic advantages can be gained in many cases by the rational introduction of various primary protection measures and by reducing the range of validity of the explosion codes within the plant. Primary measures also lead to improvement of the atmospheric hygiene at the work site and in the environment. 6 figs, 13 refs. (Author)

249. Neufeld GR
PHYSICAL HAZARDS IN THE OPERATING ROOM
Surg Clin North Am, 55(4):959-966, 1975

The physical hazards of the operating room fall into two major categories: those arising from electrical sources, and those arising from combustion processes. The purpose of this article is to review some of the physical principles relating to electrical injuries, fires, and explosions. An understanding of these physical principles is necessary for the development of rational programs for their control. (Author)

250. Anon
FIRE SAFETY PRINCIPLES BEING DEVELOPED BY A STUDY GROUP OF THE SCIENTIFIC AND TECHNICAL CONSTRUCTION CENTER
Cah Cent Sci Tech Batim, 161(1325):1-13, 1975 (French)

A special 27-man inter-institute study group has been organized in France as the Scientific and Technical Consultative Committee of the Scientific and Technical Construction Center. Its task is to work out new reliable fire-safety standards for buildings and structures. Codes are to be developed, taking into account the various fire risk factors, so as to set up fire protection standards. The various problems to be solved are: the danger of fire outbreak and spread within a premise; the risk of fire spread beyond the premise; the risk of smoke and hot toxic gas spread throughout the premise, and the risk of loss of fire resistance by structures. Each problem is examined in detail in the following sequence: required statistics, available statistics, and studies needed to supplement understanding of the given problem.

d. FIRE LOADS

251. Hagglund A
CORROSION OF STRUCTURES DURING A FIRE
Brandforsvar, 12(8/9):5, 1975 (Swedish)

The spread of plastic materials has been accompanied by a new source of fire damage, from the corrosion of equipment as a result of the effect of corrosive gases released during the combustion of plastics, especially polyvinylchloride. They can greatly exceed the damage caused by the fire itself. To reduce the damage it is necessary to know what plastics burn, the hazard they create and the measures to be taken to protect equipment. The efforts of all interested organizations, namely, fire, insurance, scientific, industrial, etc, must be harnessed to combat such fires. (Author)

252. Yakovlev AI and Sheynina LV
FIRE ENDURANCE OF SILICA CONCRETE PANELS OF INTERIOR WALLS OF BUILDINGS
Sb Tr VNII protivopozhar oborony, (2):46-57, 1974 (Russian)

Results are presented for fire endurance tests of silica concrete panels of interior walls. The tests were carried out by a method which conforms to the specifications of SNiP (Structural Standards and Codes) in a facility with an adjustable fire chamber measuring 1.3 x 1.5 m and a 200-ton hydraulic press. (Author)

253. Yakovlev AI and Apostolov AI
COMPUTER CALCULATION OF THE FIRE ENDURANCE LIMIT OF COMPRESSED REINFORCED SILICA CONCRETE STRUCTURES TAKING INTO ACCOUNT THE DEFORMATION OF HEATED CONCRETE
Sb Tr VNII protivopozhar oborony, (2):3-24, 1974 (Russian)

Experimental data on the influence of temperature on the deformation properties of silica concrete in fire situations have made it possible to develop a method of calculating the fire endurance limit of compressed reinforced silica concrete structures. (Author)

254. Gustaferro AH and Abrams MS
FIRE TESTS OF JOINTS BETWEEN PRECAST CONCRETE WALL PANELS: EFFECT OF VARIOUS JOINT TREATMENTS
J Prestr Concr Inst, 20(5):44-64, 1975

Reports the results of 14 fire tests of three-piece wall panel specimens. Each specimen is 3 x 3 ft, consisting of 3 panels 1 x 3 ft each. Thus, 28 joints were tested. Design information is given on the fire endurance of wall panel joints as affected by joint type, joint width, joint material, and panel thickness. The specimens were oriented horizontally and subjected to fire from below. 14 figs, 3 tables, 5 refs. (Author)

255. Klitgaard PS and Williamson RB
THE IMPACT OF CONTENTS ON BUILDING FIRES
J Consumer Prod Flammability, 1(4):84-113, 1975

This paper describes the results of studies conducted at the Univ of California, Berkeley, on fire behavior of building contents such as furniture and cabinet doors. 12 figs, 7 tables, 22 refs.

256. Coward SKD
A SIMULATION METHOD FOR ESTIMATING THE DISTRIBUTION OF FIRE SEVERITIES IN OFFICE ROOMS. Building Res Estab (UK), Fire Res Station; BRE CP-31-75, 6 pages, 5 figs, 6 refs, Apr 1975

The text of Building Res Estab Note No. 9/74 describes how the statistical distribution of fire severity is estimated by simulation from data obtained from surveys of office rooms. For this purpose, the 'severity' of a fire will be defined as the time taken for an equivalent exposure in a standard furnace test.

Experiments have demonstrated that the severity of a fire involving a compartment bears a relationship to the fire load, area of walls and ceiling and window area.

Values of these factors were sampled at random from their frequency distributions and combined to give an estimate of the statistical distribution of fire severity. (Author's Abstract)

257. Culver CG and Kushner J
A PROGRAM FOR SURVEY OF FIRE LOADS AND LIVE LOADS IN OFFICE BUILDINGS. Nat Bureau of Standards; NBS TN-858, 229 pages, May 1975

The development of a survey program for determining the fire loads and live loads in office buildings is described. Considerations involved in planning the program, which is directed toward establishing the factors affecting the loads in buildings, are presented. The type of data to be collected and a data collection technique which utilizes visually observed information on the characteristics of building content items to determine weight are discussed. Procedures employed to select buildings to be included in a nation-wide office building load survey being conducted by the Nat Bureau of Standards and a sampling plan for selecting rooms to be surveyed in these buildings are also discussed.

258. Culver CG
SURVEY RESULTS FOR FIRE LOADS AND LIVE LOADS IN OFFICE BUILDINGS. Nat Bureau of Standards; NBS BSS-85, 157 pages, May 1976
Availability: NTIS NBS BSS-85

Fire load and live load data obtained from a survey of 23 office buildings located in various regions throughout the United States are presented. The survey design is described including the characteristics of the building population used to select the sample. Data are presented on the magnitude and distribution of the loads. Information is also included on the characteristics of office loads such as the type of items (furniture, equipment, etc.) and their properties (material type, dimensions, exposure, etc). Statistical summaries of the data and a determination of the building and occupancy characteristics affecting these loads are presented. The data do not indicate any significant influence on load magnitude. The use of the rooms surveyed, however, did affect load magnitude. A mathematical model developed from a regression analysis of the survey data is presented for calculating fire loads and live loads in offices. The data presented may be used to evaluate current requirements for design loads for buildings. (Author)

259. Arnault P, Ehm H and Kruppa J
TEMPERATURE HISTORY IN FIRE-EXPOSED EXTERNAL COLUMNS. Centre Technique Industriel de la Construction Metallique (France); Doc CECM 3-74/7F, 33 pages, 23 figs, 4 tables, 5 refs, May 1974 (French)

The various temperatures reached by external columns exposed to fire are compiled in the appendix in the form of maximum temperature distributions, temperature history in protected columns, and some comparisons. It is evident that the external column problem is vast and requires further study. The data obtained so far, such as temperature distribution in the column, the influence of column conditions, the influence of the nature of the reflectors, and the influence of elongation, will make it possible to determine the heat stresses that can be withstood by columns. (Author)

e. HEAT AND PRESSURE LOAD EFFECTS ON STRUCTURES

260. Bub H
STRUCTURAL MEASURES OF THE CONSTRUCTIONAL FIRE PROTECTION IN THE PRECAST CONCRETE CONSTRUCTION
Precast Concrete Industry Cong, BIBM, 8th Internat, Proc; 1975, May 12-19, Stresa, Italy
Sponsor: Cement and Concrete Assoc, London

Discusses the physical effects of fire action, and structural and operational measures which can be taken to prevent total disaster. Although the state of knowledge is still very limited, experience has shown that the dangers during fire may be reduced to a minimum by reasonable structural and operational measures. As a matter of course, concrete and reinforced concrete structures have an advantage in that the building material is not combustible and the components already offer, without additional measures, a good fire resistance duration, where relatively soft systems and the joints in prefabricated construction may be advantageous. Collapse accidents have been caused almost exclusively by an insufficient fire engineering design of the total construction. 20 pages (Author's Abstract)

261. Anon
FIRE RESISTANCE OF BUILDING STRUCTURES [Ognestoykost' stroitel'nykh konstruktsiy]Sb Tr VNII protivopozhar oborony, (2) (Collection of papers of the All-Union Fire Protection Res Inst), Moscow, 1974, 184 pages, figs, 65 kopeks (Russian)

Contains articles relating to the calculation of fire resistance limits of modern building structures, including results of fire tests and new methods of conducting tests. [Individual articles abstracted separately.]

262. Sahota MS and Pagni PJ
TEMPERATURE FIELDS IN STRUCTURAL ELEMENTS SUBJECT TO FIRES. Univ of California (Berkeley), Fire Res Group; UCB FRG 75-17, 23 pages, 3 figs, 17 refs, Jun 1975
Availability: ASME Trans. Ser C. J Heat Transfer, 97(4):598-604, 1975

The transient, two-dimensional temperature field in a rectangular structural element subject to time dependent, nonlinear mixed boundary conditions has been obtained with a minimum of numerics. General results are given for two extreme fire histories, the American Society for Testing and Materials E-119 Time-Temperature Curve and a short duration high intensity time-temperature curve. Comparisons are made with finite element and experimental temperature fields in a reinforced concrete column; good agreement is obtained. The stress field generated from the analytic temperature field also shows good agreement with finite element calculations. Applications to structural fires are discussed. (Author's Abstract)

263. Yakovlev AI and Sheynina LV
COMPUTER CALCULATION OF THE FIRE RESISTANCE OF THREE-PLY WALL PANELS
Sb Tr VNII protivopozhar oborony, (2):25-45, 1974 (Russian)

A two-part calculation (thermodynamic and static) is presented of the fire resistance limits of 3-ply wall panels relative to loss of carrying capacity (total collapse). Graphs are given for the decrease in carrying capacity for different types of panels.

264. Malhotra HL
FIRE RESISTANCE - PRESENT AND FUTURE. Building Res Estab (UK), Fire Res Station; BRE CP-37-75, 7 pages, 4 figs, 13 refs, Apr 1975

This paper gives a resume of the development of standards for fire resistance in Great Britain and the United States; these have acted as the basis for international specifications. Internat collaboration has also meant that the introduction of uniform procedures in all countries is much closer. There is discussion of procedural shortcomings, the relationship with actual fires and computation of fire resistance. Future developments are considered. (Author's Abstract)

265. Baldwin R
ECONOMICS OF STRUCTURAL FIRE PROTECTION. Building Res Estab (UK), Fire Res Station; BRE CP-45-75, 11 pages, 6 figs, 20 refs, Apr 1975

A probabilistic model of the fire protection of structures through fire resistance requirements is derived, based on experiments, fire statistics and a survey of the contents of office buildings. This leads to an expression for the probability of failure of the protection for different levels of fire resistance. The model is extended to derive an expression for the economic optimum level of fire resistance, including the various risks, the expected damage and the cost of providing fire resistance. The paper also discusses the effects of increasing fire severity and the problem of trading off fire resistance against sprinklers. (Author's Abstract)

266. Anon
SPILLED FUEL IGNITION SOURCES AND COUNTERMEASURES SUMMARY REPORT. Ultrasystems, Inc, Dyn Sci Div; Dyn Sci-2310-75-119, DOT HS-801-744; 28 pages, Sep 1975
Availability: NTIS PB-246 281/OGA

This report summarizes a program which defined the conditions under which motor vehicle crash fires are ignited and proposed practicable countermeasures to reduce the incidence of these fires. Both ignition sources and fuel spillage were investigated. Electrical sparks generated from damage to the vehicle's electrical system during a crash are studied as the most hazardous ignition sources. Vehicle headlight filaments are also ignition sources. Full-scale crash tests demonstrated how commercially available inertia switches will shut off the vehicle's electrical system during frontal, front-to-rear, and rollover crashes.

f. PREVENTION AND HAZARD REDUCTION

267. Anon
PREVENTION OF SUDDEN IGNITION OF POWDERS AND EXPLOSIONS OF DISPERSED GAS SYSTEMS
(Preduprezhdenie Vnezapnykh Vosplameneniy Poroshkov i Vzryvov Gazodispersnykh Sistem)
Naukova Dumka Publ Co, Kiev, USSR; 218 pages, 1975 (Russian)

This digest of papers from the Inst for Problems With Materials of the Academy of Sciences of the Ukrainian SSR contains original articles in the field of combustion and explosion of dispersed-gas systems and in the aspiration of suspensions. The results of studies of the combustibility and explosivity of metal powders and dusts are given. Special attention is paid to methods of preventing sudden explosions and of precluding dust emission in the production and use of powdered materials.

268. Shchelkunov VI
MATHEMATICAL EXPRESSION FOR THE STANDARD TIME-TEMPERATURE CURVE IN TESTING THE FIRE STABILITY OF SHIP FIRE-PROTECTION STRUCTURES
Sb Tr VNII protivopozhar oborony, (2): 168-73, 1974 (Russian)

A mathematical expression is found for the standard time-temperature curve by plotting the curve on a semilogarithmic grid. The deviations of the design parameters from the standard curve are 5 percent after the first 30 minutes and ±15 percent in the first 10 minutes of testing.

269. Roytman VM and Zurina GN
COMPUTER SOLUTION OF THE THERMOTECHNICAL PROBLEM OF FIRE-RESISTANCE OF STRUCTURES WITH ALLOWANCE FOR MOISTURE TRANSFER USING AN IMPLICIT FINITE-DIFFERENCE SCHEME
Sb Tr VNII protivopozhar oborony, (2):58-71, 1974 (Russian)

The problem of calculating the fire resistance of structures is solved, taking into account their explosive destruction. A computational example is given.

270. Bushev VP and Rodionov GM
NEW METHOD OF ESTIMATING THE COMBUSTIBILITY OF BUILDING STRUCTURES
Sb Tr VNII protivopozhar oborony, (2):72-8, 1974 (Russian)

A method of testing and assessing building structure combustility categories has been developed and verified by the All-Union Fire Protection Res Inst of the Ministry of Internal Affairs of the USSR in collaboration with the Central Structural Components Res Inst, the Central Planning and Experimental Res Inst of Industrial Buildings and Structural Materials and the Central Res Inst for Experimental Residential Design and Planning. The method provides for quantitative and qualitative determinations. A building structure combustibility classification is presented.

271. Uddin T and Culver CG
EFFECTS OF ELEVATED TEMPERATURE ON STRUCTURAL MEMBERS
ASCE Proc. J Struct Div, 101(ST7):1531-9, 1975

The important factors which influence the behavior and strength of structural members, both steel and concrete, at elevated temperatures are examined. The characteristics of fires, the variables that influence the temperature magnitude and distribution in a fire, standard fire test methods for structural members, and material properties of steel and concrete at elevated temperature are reviewed. The study is limited to the published information available and no attempt has been made to evaluate current design principles or to establish a rational basis of design for the safe use of structural members for elevated temperature applications. The paper concludes with an extensive list of references dealing with various aspects of the problem.

272. Mansfield JA, Riccitiello SR and Fewell LL
EFFECTIVE AND PRACTICAL FIRE PROTECTION SYSTEM
J Fire Flammability, 6(4):492-8, 1975

A fire-protection system of sandwich configuration, called a sheath system, is described. Advantages of the sheath system over fire-protection coatings are discussed. A comparison is given of laboratory fire-protection performance data, showing that performance for some sheath systems is superior to state-of-the-art fire-protection coatings. 1 ref.

273. Bamert E
OCCUPANT SAFETY HAZARDS - RESPONSIBILITIES OF MANAGEMENT
Fire_Prot__Conf,_Internat; 1975, Apr/May, Amsterdam, pages 25-29

Assurance of adequate fire protection for highrise building occupants is technically possible from the standpoint of today's knowledge and methods. On the basis of a discussion of occupant safety hazards and requirements related to occupant safety facilities, including evacuation and rescue requirements, monitoring, alarm and communication systems, security center, suppression equipment and the like, the responsibilities of management are reduced to the provision of a fire safety advisor and fire safety organization. The duties of the advisor and organization are outlined. 11 refs.

274. Dixon HM
REDUCING DUST FIRES AND EXPLOSIONS
Fire_Eng_J, 36(101):10-12, 1976

Many dusts are combustible, and when ignited in a heap or layer can smolder for a considerable time. Some of these can give rise to dust explosions when dispersed in the air at a suitable concentration. Measures that can be taken to reduce the risks include the provision of extraction systems to remove the dust, the control of ignition sources, and the provision of safety systems such as explosion reliefs, explosion suppression devices, the siting of plant in safe locations and segregation between separate items of plant. 3 figs, 6 refs. (Author)

275. Byrd J and Burgess J
THE CHILD-RESISTANT MATCHBOOK "...A BETTER MOUSETRAP"
Fire_J, 70(3):11-17, 1976

The history of the development of the child-resistant matchbook, the potential advantages, hazards and economic impact, are described. A series of 9 photographs illustrate the lighting procedures for the matchbook. 9 photos.

276. Laurin J-C
FIRE, OUTBREAK OF FIRE, MATERIALS TESTING
Cour_Norm, (246):517-520, 1975 (French)

Excessive concentration on the limited area of fire tests of materials and building components can lead to neglect of the part played by such tests in limiting fire risks and of their relationship to outbreak of fire. Emphasis should be placed on the calculation and design of buildings as well as on urban organization. Other factors to be considered are the detection and warning devices, location of fire-fighting and evacuation means, building collapse prevention in the design stage, fire loads, ventilation, etc., all of which are discussed. 1 fig.

277. Gavriley VM, Son EG and Lupanova LI
STATISTICAL ANALYSIS OF THE TIME EXPENDED IN CARRYING OUT FIRE-PREVENTION WORK
Vopr_ekon_pozhar_okhrane, (3):15-30, 1974 (Russian)

An analysis is made of charts for automatic keeping of the working time expended by 2,500 employees of agencies of the Fire Protection Admin and Fire Protection Departments. (Author)

278. Lorenzen H
DAMAGE PREVENTION AT CONSTRUCTION SITES
VFDB_Z, 24(3):117-118, 1975 (German)

The fire hazard increases as construction work progresses and is sometimes greatest just before completion. The author mentions precautions and rules and regulations of importance for fire safety from which special requirements can be specified regarding construction and operations. Fire protection conditions can be improved decisively only if regular control and inspection of the construction site by fire officials is carried out. Fire insurance companies expect to contribute materially to improvement of fire protection by their investigations and cooperation. (Author)

279. Dechime L
GREATER HAZARDS TO FIRE FIGHTERS DEMAND GREATER SAFETY EFFORTS
Fire Eng, 129(4):43-44, 1976

Death and injuries confirm that fire fighting is the most hazardous occupation in the United States. Although fire fighting will never become a safe occupation, awareness of the inherent conditions involved, anticipation of the potential for death and serious injury, and the willingness of fire fighters to plan and act accordingly will make it a safer occupation. Various safety and hazard aspects are identified, such as reduction or elimination of risk and injury severity, application of science and technology to increase protection, hazards inherent in the modern fire fighting environments of high-rise construction, use of plastics, and the abundance of hazardous chemicals and fuels. The safety committee, safety officer, and safety practices of the Miami Fire Department are outlined.

280. Anon
IMPROVEMENTS IN FLAME ARRESTERS
UK Patent No. 1,385,598, Cl A5A, (A62C 4/00), Appl 17 Aug 73, Discl 26 Feb 75, Assignee: Laurence, Scott and Electromotors, Ltd

At the entrance the flame arrester has a pack of metal screens, initially with a high and then with a low melting temperature. Porous metal filters with pore size decreasing toward the outside are mounted at the outlet. The flame arresters are used, for example, to protect electrical equipment, where powerful electric arcs may occur. 1 fig. (Author)

281. Otey FH, Westhoff RP and Mehltretter CL
FLAME-RETARDANT POLYURETHANE FOAMS
US Patent No. 3,926,868, Cl 260-2.5, (C08G 18/14, 18/50), Appl 16 Jan 74, Discl 16 Dec 75, Assignee: US Dept of Agriculture

Highly flame-resistant rigid foams are obtained by the use of novel halogen-containing polyols in the polyurethane synthesis. These foamed products have many applications such as insulators and filters.

282. Cotugno LA, Zborovszky Z and Finard G
A SAFETY ANALYSIS COMPUTER PROGRAM FOR EVALUATION OF COMPLICATED ELECTRICAL CIRCUITS REPRESENTING IGNITION HAZARDS. A COMPREHENSIVE STUDY OF INTRINSIC SAFETY CRITERIA. Denver Res Inst, CO; BUMINES OFR-43-76, 118 pages, Nov 1974
Availability: NTIS PB-250 389/4GA

The purpose of this study was to develop a computer program designed to help testing personnel in the evaluation of complicated electrical circuits by calling attention to those circuit branches that could represent ignition hazards under normal conditions of operation or in case of assumed faults. This report contains a digital computer program intended to facilitate approval testing procedures for discrete component circuits through identification of the junctions most liable to represent hazardous failure circumstances. (Author)

283. Gagliani J
FIRE RESISTANT RESILIENT FOAMS. FINAL REPORT, 1 JUL 1975-16 FEB 1976. Solar, San Diego, CA, Res Dept; NASA CR-147496, SO-6-4446-0, 72 pages, Feb 1976
Availability: NTIS

Primary program objectives were the formulation, screening, optimization and characterization of open-cell, fire resistant, low-smoke emitting, thermally stable, resilient polyimide foams suitable for seat cushions in commercial aircraft and spacecraft. Secondary program objectives were to obtain maximum improvement of the tension, elongation and tear characteristics of the foams, while maintaining the resiliency, thermal stability, low smoke emission and other desirable attributes of these materials. (Author)

g. SUPPRESSION DEVICES AND EQUIPMENT

284. Bryan JL
AUTOMATIC SPRINKLER AND STANDPIPE SYSTEMS
Nat Fire Prot Assoc, Boston; 400 pages, 1976

This new textbook explains the basic principles involved in the design, installation and function of such systems. (Author)

285. Solodovnikov AM
CYLINDRICAL FOAM GENERATOR AND CALCULATION METHOD
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3; 1974, All-Union Fire Protection Res Inst, Moscow, pages 3-8
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

Given are the design and method of calculating a foam generator in which air compressed at a pressure of 0.15-0.10 kg/cm² instead of the 1.5-2.0 kg/cm² of the existing apparatus is used. (Author)

286. Vasil'ev AD
FOAM-GENERATOR PROPORTIONING IN AUTOMATIC FIRE EXTINCTION SYSTEMS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3; 1974, All-Union Fire Protection Res Inst, Moscow, pages 23-32
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The existing methods of foam-generator proportioning in automatic fire extinguishing systems are examined, such as tank, pump and ejector proportioners. The advantages and deficiencies of all the methods are given as well as methods of calculating them. (Author)

287. Vasil'ev AD
NEW FOAM CHAMBER DESIGNS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3; 1974, All-Union Fire Protection Res Inst, Moscow, pages 15-22
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The structural features of different types of foam chambers attached to fuel storage tanks for fire suppression are considered. (Author)

288. Reutt VCh and Bychkov AI
MECHANISM OF FOAM GENERATION ON SCREENS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3; 1974, All-Union Fire Protection Res Inst, Moscow, pages 9-14
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

Data on the study of the mechanism of foam generation from a single droplet are given. It is concluded that the cutoff of foam generation under the experimental conditions is characterized by a dimensionless parameter equal to the ratio of the pressure forces to the forces of surface tension. (Author)

289. Ferrie M
SMOKE CONTROL IN HIGH BUILDINGS
Fire Internat, 5(51):18-28, 1976 (English, French, German; Spanish abstract)

The author analyses various smoke control principles based on mechanical ventilation which have been laboratory tested and verified by field tests in vacant high-rise buildings of 30 and 40 stories, and one occupied 18-story building. The basic problem is to prevent fumes from a fire-affected area reaching an unaffected area via an intermediary area by providing a flow of fresh air from the unaffected to the affected area. A number of solutions is examined and evaluated from the standpoint of safety and reliability in use, ease of adjustment, operation, inspection and maintenance, financial economics, and effectiveness of natural-draft systems and economics. Two new devices are considered to satisfy these requirements, namely, smoke control vents which open when fire is detected and close when the temperature rises abnormally and doors which shut automatically and incorporate such vents. 4 figs, 2 tables, 7 refs.

290. Meier H-U
OPERATING CHARACTERISTICS, DESIGN PROBLEMS AND TESTS OF SMOKE AND HEAT REMOVAL SYSTEMS
VFDB Z, 25(2):50-55, 1976 (German)

Flow investigations were made of simplified models of smoke and heat venting systems at the Aerodynamic Research Inst of the German Research and Development Establishment for Aeronautics and Astronautics in Goettingen. Visual observations of flows in such systems in a water basin yielded information on flow behavior under simulated side-wind conditions. The dependence of system efficiency on the geometrical data, such as height, with particular consideration of side wind, was determined by supplementary studies in the 1-m low-velocity tunnel. In addition, the experimental technique was checked with respect to the effects of Reynolds number. 9 figs.

291. Kushnarev AM, Shul'ga YuN, Brusentsev GK, Privalov NI and Yur'ev AP
EFFECTIVENESS OF UNDERGROUND FIRE SUPPRESSION WITH PORTABLE FIRE EXTINGUISHERS
Gorno spasat delo, (10):22-26, 1975 (Russian)

Data on the extinction of fires in the initial stage with portable fire extinguishers are analyzed. It is concluded that the operational reliability of fire extinguishers and their fire-extinguishing capability must be increased and the distribution of extinguishers in mines must be improved. (Author)

292. Kozlyuk AI, Grin GV, Zimina AF and Kuz NA
DETERMINING THE MASS FLOW OF WATER FOR A WATER FIRE CURTAIN
Gorno spasat delo, (10):12-16, 1975 (Russian)

The calculated temperature of fire gases after passing through a curtain at various mass flow rates of water and velocity of the air stream in mine workings of irregular cross section has been found by theoretical research. The theoretical calculations agree with experimental data obtained in the experimental gallery of the All-Union Mining Res Inst. The investigations have made it possible to establish standards for the flow of water required to form water curtains. 2 figs, 1 table, 6 refs. (Author)

293. Itskov AI
OPERATING EFFICIENCY OF AUTOMATIC FIRE EXTINGUISHING INSTALLATIONS
Vopr ekon pozhar okhrane, (3):82-94, 1974 (Russian)

The reliability aspects of automatic fire extinguishing installations are examined. The low operational readiness (0.69) is noted. For this reason 25 percent of the fires that broke out in facilities equipped with automatic fire extinguishing installations were not extinguished. Methods of increasing the effectiveness and reliability of such installations are considered. (Author)

294. Enomoto K, Nagai I, Horii K and Konisi M
DEVELOPMENT OF AUTOMATIC WATER CURTAIN SYSTEM
Rep Fire Sci Lab (Japan), (11):25-28, 1974 (Japanese)

295. Sachkov AF, Viglin VE, Gornyy AV and Gusev VN
NEW FOG NOZZLES
Bezop tr prom-sti, (8):56-57, 1975 (Russian)

A description and the operating principle of new designs of fog nozzles for the suppression of dust while cutting underground mine workings are given. The special feature of these fog nozzles is the capability of remote control. 2 figs, 1 table.

296. Grin GV, Kharlamov BN and Gavrish YuV
STUDY OF THE PROCESS OF APPLYING A FIRE-EXTINGUISHING POWDER TO A BURNING SURFACE FROM A FIXED INSTALLATION
Gorno spasat delo, (10):16-20, 1975 (Russian)

When powder and gas are discharged from an installation, the mixture is entrained by the co-flow of air, and it is therefore necessary to determine beforehand the positioning of the sprays. As a result of research, relations have been obtained which permit determination of the magnitude of the zones of the surface being protected where the greatest deposit of powder from the fixed spray is obtained. 3 figs, 1 table, 2 refs. (Author)

297. Cerrina FG
FIXED FIRE-FIGHTING SYSTEMS IN VARNISH AND PAINT FACTORIES FOR THE PRINTING INDUSTRY
Antincendio protez civ, 27(6):442-450, 1975 (Italian)

Chemical and mechanical foams can be used to extinguish varnish and paint fires. The mechanical foams are more frequently used because they are cheaper and the foam-producing devices are simpler. The technical and economic aspects of using low (6-12), medium (30-200) and high (300-1000) expansion foams to extinguish area and volume fires are considered. The special features of using foams to extinguish Class A and B fires are emphasized. It is noted that the effectiveness of foam systems is largely dependent on the quality of the foam generator and its durability. Variant uses of foam in combinational suppression with other extinguishing agents (powder, water, gas, etc) are presented. Also discussed are the technical conditions for using carbon dioxide gas to protect varnish and paint plants. The physical properties of carbon dioxide at various temperatures and pressures are given, as are the mechanism of extinction with carbon dioxide, the suppression standards for local and bulk protection for Class A and B fires, the operational characteristics for slow- and fast-discharge systems, high- and low-pressure systems. (Author)

298. Anon
PRESSURIZATION SYSTEMS DESIGN REQUIREMENTS FOR CONTROL OF SMOKE
Fire_Prot_Rev, 39(423):61,63,65,67, 1976

The pressurization systems used in buildings to control smoke on escape routes are considered. Some of the main points from relevant papers presented at a recent CIB two-day symposium held by the Fire Research Station, Building Research Establishment (UK) concerned with the control of smoke movement in building fires are reviewed.

299. Anon
EXTINGUISHERS FOR FIRST AID FIRE FIGHTING
Fire_Prot_Rev, 39(422):18,20-21,23, 1976

The selection of extinguishers now available for first-aid (immediate) firefighting is reviewed. The need for all premises to be equipped with the types of extinguishers required for the risks involved and for safe and easy use by inexperienced people is emphasized.

300. Sima M, Agawa M and Saito M
NEW FIRE EXTINGUISHER WITH TWO SOLUTIONS
Rep_Fire_Sci_Lab_(Japan), (11):12-5, 1974 (Japanese)

A description is given of the design, operating principles, technical data, and test results for a new portable fire extinguisher. Its outstanding feature is the two components contained in a small inner flask: a foam-forming powder in a separate flask and a sealed capsule with carbon dioxide. When the fire extinguisher is used, the fire extinguishing foam is formed with three components participating, the water which is contained in the main, larger cylinder of the extinguisher, the powder, and the CO(2). The capacity of the larger cylinder is 9.5 liters; the quantity of water with which the larger cylinder is filled is 6 to 7 liters, the overall height of the extinguisher is 665 mm; the inner diameter of the large cylinder is 160 mm; the length of the inner flask containing the small powder flask and the CO(2) capsule is 450 mm; the diameter of the inner flask is 50 mm; the quantity of foam-forming powders is 350 to 420 cm³; the diameter of the delivery orifice is 3.5 mm; the weight of the extinguisher without water is 5.93 kg; water-filled it is 13.3 kg; the continuous operating time is about 40 sec; the spray range is 5 to 10 m; the quantity of fire-extinguishing foam generated is 65 to 95 liters; the foam expansion factor is 10 to 13; the maximum pressure developed at the first instant of operation is 10 kg/cm². Graphic information illustrating the time dependence of the pressure in the extinguisher, the intensity of the foam jet and the range of delivery is given. 5 figs, 2 tables.

301. Halpaap W
SMOKE AND HEAT REMOVAL IN FIRES
VFDB_Z, 25(1):21-28, 1976 (German)

The problem of smoke and heat removal during fires has been under discussion since November 1973. To date only the insurance companies have established guidelines. It is the aim of the standards committee to find a solution which would be suitable for the drafting of a public law. The existing rules are being scrutinized, ideas and opinions are being subjected to a rigorous critique. The present article is intended to contribute toward reaching a consensus in this regard. 5 figs, 2 tables, 8 refs.

302. Imadzu H and Hashegawa K
INFLATABLE SMOKE-CUT SHUTTER
Rep_Fire_Sci_Lab_(Japan), (11):60-3, 1974 (Japanese)

A description is given of the design, operating principle and parameters of an automatically actuated system of inflatable smoke cutters to be used in case of fire in buildings with a forced fresh-air supply system, as in some types of multistory highrise buildings, especially in the underground floors of such buildings. The system consists of compressed-air cylinders fixed to the ceiling. Normally the smoke shutters are folded up in special enclosed ceiling compartments. In case of fire and smoke suppression, the smoke detectors are triggered, opening the covers and the valves of the compressed air cylinders. The smoke-cutting shutters drop down from the compartments and are filled with air, forming barriers which seal off the building corridors and other areas in that section. The system is actuated only on the fire-affected floor, thus isolating the smoke source. The barriers contain escape hatches. 7 figs, 1 table.

303. Ammosov FA, Dubovik VI, Turkov AS and Stetsovskiy MP
TESTING A SMOKE PROTECTION SYSTEM FOR A HIGH-RISE RESIDENTIAL BUILDING
Sb Tr VNII protivopozhar oborony, (2): 121-6, 1974 (Russian)

Test results are given for a smoke protection system in the form of smoke removal from a corridor and of air pressurization in the elevator shafts of a 14-story, free-standing residential building.

304. Sima M, Agawa M and Umezhawa M
DEVELOPMENT OF ELECTROSTATIC SMOKE REMOVAL SYSTEM
Rep Fire Sci Lab (Japan), (11):54-9, 1974 (Japanese)

The design, technical data and the results of testing two different versions of systems of electrostatic smoke removal from a premise in a fire are presented. The test data are an extension of analogous tests that were carried out on previous models (1,2,3) of electrostatic systems, which differ from the new models (4 and 5) in design, dimensions, power of the supply sources, output, and in part, purpose. Models 4 and 5 are stationary, designed to operate in conjunction with complex automatic fire systems installed in large administrative and residential buildings. The operating principle of the smoke removal (suppression) devices is based on the interaction between electrodes charged with a high static potential and particles of soot and vapor in the mass of smoke, i.e. ionized electrostatic particles. Used in Models 1, 2 and 3 were electrodes in the form of extension-type rod and telescopic antennas having a potential opposite that of the ionized particles and therefore attractive to the smoke particle. Models 4 and 5 are also based on the attracting interaction of differently polarized charged particles, but they have the important difference of employing not electrostatic force, but mechanical extraction of smoke through a powerful ventilator into a special chamber containing the electrode components. The latter are made in the form of horizontal and vertical metal plates; their mutual perpendicular plane of intersection divides the working chamber into longitudinal rectangular ducts (cells) of square cross section. The forward end of the device is a grid structure. A powerful fan-blade ventilator is located under the cover of the rear face of the panel. When the smoke stream is drawn into the cells of the working chamber by the ventilator, it is forced to settle on the surface of the electrode plates in the form of a layer of soot and vapor, while the cleared mass of air exits through a special exhaust duct. The surface area of the suction grid is 450 x 450 mm; the length of the device is 60 mm; the feed source power of model 4 is 270W and 240W of model 5, the diameter of the ventilator blades is 45 cm (model 4) and 40 cm (model 5). The uniformity of the suction action produced by the ventilator on the grid surface of the front panel was evaluated during the tests. 2 figs, 2 tables.

305. Tamblyn RT
HIGH-RISE HALON
ASHRAE J, 18(2):20-2, 1976

The use of Halon 1301 as a fire extinguishant involving a central supply of Halon together with a pipe header to release the gas selectively to the fire flow has been successfully tested. The potential for Halon 1301 as an economical and flexible agent for fire suppression in buildings which use compartmented air handling systems is also examined. (Author's Abstract)

306. Smith CO
FAILURE IN TWO FIRE EXTINGUISHERS
ASME Trans. Ser H. J Eng Mater Technol, 97(4):367-70, 1975

Failures of two fire extinguishers are examined in this paper detailing circumstances, laboratory examination, and analysis of failure. Both failures resulted in serious injury to the individual handling the extinguisher at the time of failure. Both failures could have been prevented by implementation of well-known technology. (Author's Abstract)

307. Alvares NJ, Kanury AM, Wiersma SJ and Pefley RK
FIRESAFE SANCTUARIES FOR HIGH-RISE STRUCTURES
Fire Technol, 11(4):241-54, 1975

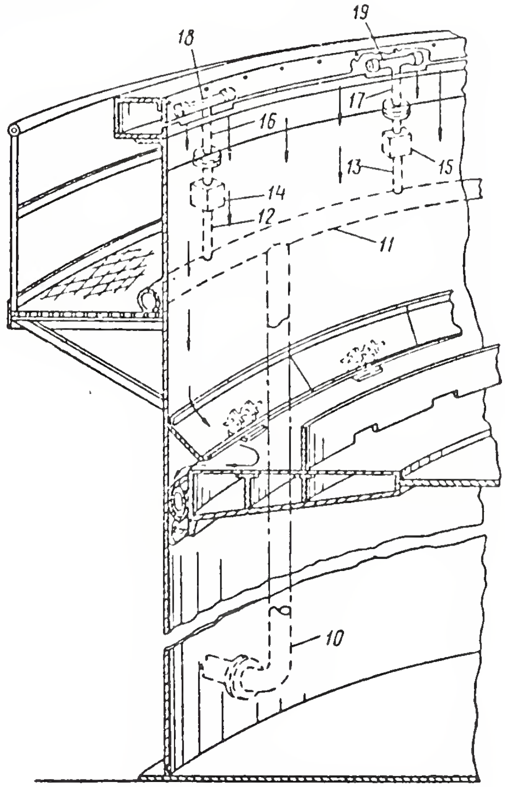
Using extensively available information on heat transfer, construction methods, ventilation, and human transient thermal response, the authors demonstrate the feasibility of the concept of firesafe sanctuaries for highrise structures. The paper discusses existing evidence in support of the utility of firesafe sanctuaries in conjunction with, or as alternatives to, sprinklers for highrise structures. Areas of investigation that will either confirm the feasibility of the firesafe sanctuary concept or remove it from further consideration are pointed out. 9 figs, 6 refs.

308. Fung FCW
SMOKE CONTROL BY SYSTEMATIC PRESSURIZATION
Fire Technol, 11(4):261-9, 1975

A series of full-scale smoke movement experiments were conducted by the Nat Bureau of Standards in selected highrise buildings using a sulfur hexafluoride tracer technique for smoke simulation. These experiments were designed to study the effectiveness of this new smoke control system. 9 figs, 12 refs.

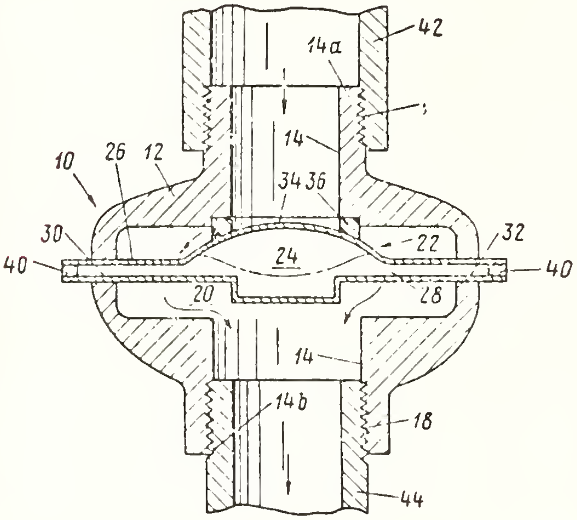
309. Blomquist DL and Almus FW
FOAM FIRE-EXTINGUISHING DEVICE FOR WALLED CONTAINERS
US Patent No. 3,876,010, Cl 169-46, (A62c 3/12), Appl 26 Dec 73, Discl 8 Apr 75

The patent is for a fixed foam fire-extinguishing device for the protection of flammable-liquid storage containers. The device is mounted on the wall of the container and consists of an annular pipe 11 (see the figure) and a delivery pipe for the foam-producing solution. Standpipes 12,13 with foam generators 14,15 project upward from the annular pipe 11 uniformly over the circumference; the foam compound is delivered from the generators 14,15 through pipes 16,17 to the foam nozzles 18,19 which are located in a metal duct along the upper edge of the container. The container side of the duct has a slot through which foam from the nozzles is applied uniformly along the entire circumference of the container onto the surface of the burning liquid, cooling the upper part of the container wall. 3 figs. (Author)



310. Livingston WL
FLUID CONTROL DEVICE AND A FIRE PROTECTION SYSTEM INCORPORATING SAID DEVICE
US Patent No. 3,871,457, Cl 169-20, (A62c 37/06), Appl 4 Mar 74, Discl 18 Mar 75, Assignee: Factory Mutual Res Corp

Patent is disclosed for a valve assembly for sprinkler heads used in automatic fluid fire-extinguishing systems. The valve assembly 10 (see the figure) separates the sprinkler head 44 from the pipe system 42 filled with pressurized fluid fire extinguishant. The valve assembly consists of a housing 12 containing a device 22 made of elastic material. The inner cavity of the device is filled with compressed gas; the convex outer surface 34 for closing the sprinkler heads is pressed tightly against valve 36; the rod portions 26,28 project outside the valve assembly through openings 30,32 in the housing and are stopped up by low-melting inserts 40. Under normal conditions the gas pressure in the cavity of the device is greater than the pressure of the fluid above the assembly. When the air temperature rises in the area where the sprinkler head is located, the inserts melt, the gas pressure of the device drops and the valve opens. 2 figs. (Author)

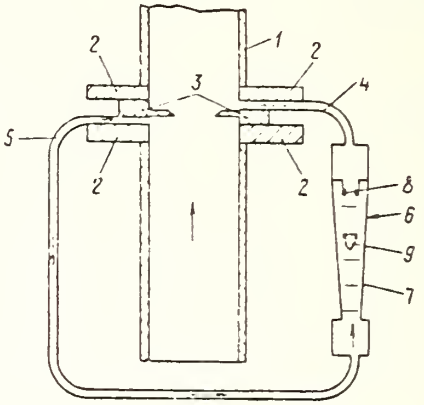


311. Vigar AD

IMPROVEMENTS RELATING TO FIRE EXTINGUISHING SPRINKLER SYSTEMS

UK Patent No. 1,396,377, Cl A5A, (A62c 37/22), Appl 21 Aug 72, Discl 4 Jun 75, Assignee: G.A. Platon, Ltd

The patent is issued for a device to check the operating efficiency of a sprinkler system (see the figure). It is mounted on the pipe feeding the sprinkler. It consists of a pipe 1 and a plate 3 fixed between flanges 2. Connected to the pipe on either side are two small pipes 4 and 5, to which the metering device 6 is connected. The meter is made in the form of a conical housing 7 and is equipped with a scale which indicates the rate of flow of the liquid. The upper part of the housing contains a flow limiter 8. The float 9 moves freely in the housing and takes up a position corresponding to the flow rate in the sprinkler system. 1 fig. (Author)



312. Getz MR

EXTINGUISHER CHARGING SYSTEM

US Patent No. 3,875,980, Cl 141-83, (B65b 3/28), Appl 14 May 73, Discl 8 Apr 75, Assignee: Pyro Control, Inc

A patent is issued for a system of charging powder fire extinguishers by the "vacuum filling" method. The system includes a vacuum system consisting of a vacuum pump, an evacuated container, control and monitoring elements, filters, conduits, and other parts. The vacuum maintained in the evacuated container automatically fluctuates in the range 355-508mm H_2O. Powder from any of three powder containers, with funnel-shaped bottoms, is supplied through one of these conduits connecting the powder container with the orifice of the fire extinguisher. A vacuum tube is connected to the powder-supply conduit in the immediate vicinity of the assembly which attaches the conduit to the entrance orifice of the fire extinguisher. The extinguisher is placed on a weighing device which constantly monitors the level of the powder filling. In this system the assembly which connects the conduit to the entrance orifice of the extinguisher is made of an elastic material and is conical in shape, which makes it possible to charge fire extinguishers with any size of orifice. Since the system has several powder containers, various types of powder can be fed into the extinguishers. (Author)

313. Kozlyuk AI, Rybalko SF and Shchetser GM

FOAM GENERATOR

USSR Patent No. 454,028, Cl A62C 35/44, Appl 12 Jul 72, Discl 19 Feb 75, Assignee: VNII protivopozhar oborony

A foam generator for the production and delivery of fire-extinguishing mechanical foam is patented. The foam generator includes a housing, a spray tip, and pack of screens. Its distinctive feature is the dry foam-compound cavity in the housing between the spray tip and the pack of screens. It is made in the form of a magazine with cellular covers and honeycomb cells between them to ensure foam delivery when the temperatures of the ambient medium are negative. (Author)

314. Williams RA

FIRE EXTINGUISHERS

US Patent No. 3,874,458, Cl 169-59, (A62c 35/02), Appl 12 Nov 73, Discl 1 Apr 75, Assignee: Pyro Control, Inc

The fire extinguisher is made in the form of a hermetically sealed, double-walled container holding a pressurized fire-extinguishing gas, e.g. freon (halon) 1301. In the outer wall of the lower part of the container are placed shaped charges which are triggered when the temperature rises, perforating the outer wall, through which the gas passes from the container. (Author)

315. Fudge WL

FIRE EXTINGUISHER CABINET

US Patent No. 3,872,999, Cl 220-270, (B65d 41/32), Appl 29 Apr 74, Discl 25 Mar 75, Assignee: Larsen's Mfg Corp

A patent is disclosed for a cabinet designed for storage of a fire extinguisher which can be reached quickly in case of fire. The cabinet consists of a vertical container with a rectangular bottom, a top, and lateral metal walls interconnected by metal angle bars. The front wall of the container is a rectangular panel made of a frangible material such as plastic, to the center of which a handle is attached with screws. The central portion of the panel is weakened along a certian continuous outline by notching in such a way that when a specific force is applied to the handle, the panel fractures along the notched lines, affording access to the fire extinguisher. The advantages of this configuration consist in the absence of dangerous fragments or sharp panel edges when the cabinet is opened. (Author)

316. Livingston WL

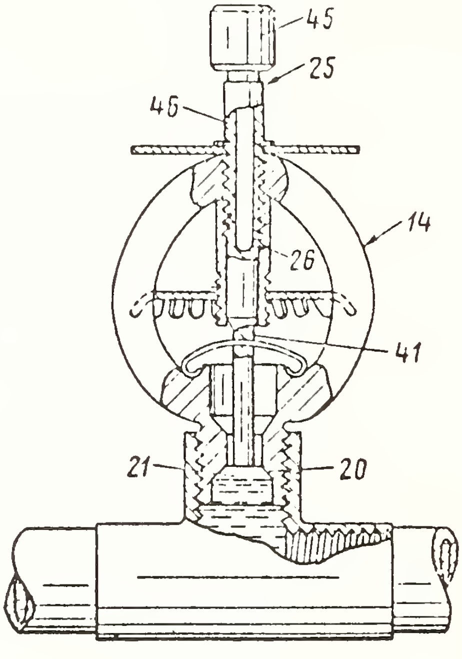
FLUID DISCHARGE ASSEMBLY HAVING A TILTABLE DISCHARGE PORTION AND A DISCHARGE CONTROL SYSTEM INCORPORATING A PLURALITY OF SAID ASSEMBLIES

US Patent No. 3,872,928, Cl 169-56, (A62c 37/10), Appl 7 Jun 74, Discl 25 Mar 75, Assignee: Factory Mutual Res Corp

The patent is for a sprinkler head, distinct in that it has an automatic orientation device which ensures required tilting of the head in any plane to direct the stream of fluid to the fire center. The automatic orientation device includes a corrugated metal nozzle between the input orifice of the head and the output sleeve of the ceiling supply conduit. On the outside of the corrugated nozzle are bimetallic cambered bands, radially located, connecting the end portions of the nozzle. Each bimetallic band is insulated from the other by a thermal shield, a simple metal plate. In the case of a fire breaking out not directly beneath the sprinkler head, but to the side of it, the bimetallic bands change their configuration toward the center of the fire under the influence of the thermal radiation. As a result, the sprinkler head is tilted by means of the corrugated nozzle toward the fire and, when the fusible element melts, the fire-extinguishing fluid is applied directly on the fire. The output orifice of the head has a supplementary annular slit with a deflector and an atomizer screen. With this arrangement a portion of the fire-extinguishing fluid, when it hits the annular slit, is deflected upward by the deflector and cools somewhat the heated bimetallic bands, ensuring stabilization of the optimal orientation.

317. Klesow GF
AUTOMATIC SPRINKLER VALVE
US Patent No. 3,874,455, Cl 169-19, (A62c 37/06), Appl 20 Jun 74, Discl 1 Apr 75

A valve assembly is patented for sprinkler heads used in automatic water fire extinguishing systems. The head 14 (see figure) is connected to the conduit by means of a threaded box. The valve assembly within the head contains valve 21 on a stem, a spring fixed to the head and passing through a hole drilled in the stem, a deflector, a triggering device 25 with a heat-sensitive element 45 containing a readily fusible material which expands when it melts, e.g. paraffin or wax. The head operates as follows: in normal conditions valve 21 is pressed against the seat by the water pressure and the spring. When the air temperature in the area where the head is located rises, the wax in the heat-sensitive element melts, increasing in volume and filling the chamber around the spindle 46. Piston 26 presses against the end of the rod, overcomes the force of the spring and the water pressure, and the valve opens. When the temperature of the ambient medium decreases, the paraffin in the triggering device becomes solid, it decreases in volume, and the stem returns to its original position under the effect of the force of the spring and water pressure, closing the valve. 3 figs. (Author)



318. Isaev MN
FIRE EXTINGUISHING SYSTEMS
USSR Patent No. 446,279, Cl A62c 35/50, Appl 11 Apr 73, Discl 15 Dec 74, Assignee: VNII protivopozhar oborony

319. Veselov AI, Tubashov LK, Balagin PG and Yarosh VA
DEVICE FOR LIQUID ATOMIZATION
USSR Patent No. 455,746, Cl B05b 3/16, A63c 35/54, Appl 17 Oct 72, Discl 20 Feb 75, Assignee: VNII protivopozhar oborony

320. Henningsen LA
FIRE PUMP CONTROL APPARATUS
US Patent No. 3,859,565, Cl 317-13R (H 02 h 9100), Appl 20 Aug 73, Discl 7 Jan 75, Assignee: Firetrol, Inc

Patent for an apparatus which automatically actuates a fire pump in a highrise building. Considered is the sharp increase in power over nominal upon motor ignition, resulting in overheating and burnout of wiring, generation of an electrical arc, and possible start of fire. The circuit of the apparatus provides for reducing the starting current by 3-stage start-up of the motor and increasing the time of motor acceleration to nominal rpm. The apparatus contains timers to reduce the effective maximum starting-current time (exceeding the nominal by a factor of 5) to 0.004 sec; the motor uses current 9 times greater than nominal for 6-8 sec. The motor reaches top rpm in 60 sec, using current less than 3 times the nominal, thus avoiding fire risk. 5 figs.

321. Furukawa K, Kitani S and Yamada E
METHOD OF PREVENTING HIGH TEMPERATURE LIQUID SODIUM FIRES
Japan Patent No. 74-18327/B, Cl (unknown), Discl 28 Jan 1969, Assignee: Japan Atomic Energy Res Inst, Tokyo

A method is presented of extinguishing fires caused by liquid sodium without damaging machines and apparatus in the work area. The method comprises: 1) maintaining a constant environment in the work area (e.g. normal atmospheric pressure, 20°C, and a water vapor content of 12g/m³); 2) providing a reserve space containing an inert gas and water vapor in a quantity equivalent to that of the working space and isolated from it; 3) maintaining the reserve space in a compressed state (e.g. 3 atm); 4) mixing both gases upon the outbreak of fire by removing the isolating member; and 5) reducing the oxygen content of the mixed gas to a value in which the sodium is no longer combustible.

322. Kusakabe S
DEVICE FOR THE PREVENTION OF FIRE SPREAD
Japan Patent No. 49-44518, Cl 95 AO, (F24 f 13/00), Appl. 23 Aug 68, Discl 28 Nov 74, Assignee: Nittan Co

A patent is granted for the mechanism and working principles of an electromechanical device designed to seal off the cross section of an air-duct box connecting the compartments of a building in case of fire to prevent the fire from spreading. It is mounted in a unit section of a rectangular air-duct box in a wall opening between two compartments. It consists of an electromagnetic coil with a core (solenoid), a fire detector, a relay, and two baffles within the section fixed to controllable horizontal axes. The axes are coupled via a lever actuator to the core of the solenoid and can be turned to a position in which the baffles form a single panel conforming in area and configuration to the inner cross section of the air duct. The electromagnet winding is connected across the normally open relay contacts to an external ac net. In case of fire, the detector is triggered (not necessarily an integral component of the set); its low-current circuit is connected to the relay winding. When the relay is actuated, its contacts close the electromagnet supply circuit, causing the core to displace, thus positioning the baffles perpendicular to the longitudinal axis of the duct, preventing the fire from spreading. 5 figs, 1 ref.

323. Livingston WL
DISCHARGE HEAD FOR A FIXED FIRE EXTINGUISHING SYSTEM
US Patent No. 3,821,986, Cl 169-41, (A 62 c 37/12) Appl. 3 Mar 71, Discl 2 Jul 74, Assignee: Factory Mutual Res Corp

A patent is granted for the discharge head of automatic fire extinguishing systems (Fig. 1) consisting of a housing 12 containing a swirl vane 18a,18b through which runs a sleeve 20 rigidly fixed to the vane. The upper part of the sleeve has a small opening. Inside the sleeve is a rod 22 terminating at the bottom in a shut-off valve 24 with gaskets 52,54,56 (Fig. 2). Rod 22 is held in position at the top by lock pin 32, the right end of which is pressed against the low-melting element 44 under the pressure of spring 48. When the air temperature rises at the point where the extinguisher is located, the low-melting element 44 deteriorates, lock pin 32

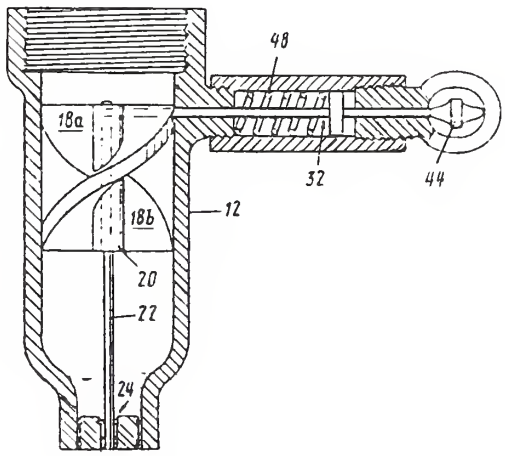


Fig. 1

moves to the right, releasing rod 22, which is ejected from the extinguisher, along with lock 24, freeing the water duct. What is new in this version is the lock 24 (see Fig. 2), the housing of which is soldered to rod 22 with solder 58, which has a higher melting point than the low-melting element 44 (see Fig. 1).

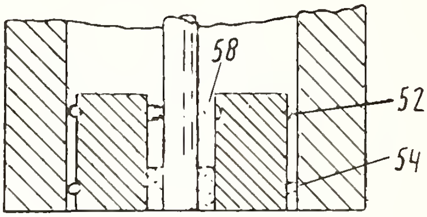


Fig. 2

If the lock fails to operate because of corrosion, jamming, etc, a further increase in temperature causes solder 58 to melt, releasing lock 24, which is ejected from the extinguisher by the pressure of the water.

324. Bock AE
REVIEW AND ASSESSMENT OF SMOKE ABATEMENT DEVELOPMENT FOR U.S. NAVY FIRE FIGHTING FACILITIES (1965-1975). US Nav Acad, Annapolis, MD, Energy-Environ Study Group; USNA EPRO-15, 32 pages, Oct 1975
Availability: NTIS

This study traces the development of two fire fighting school smoke abatement systems, the Water Spray System and the After Burner System, from their inception to their states of development in mid-1975. Included are descriptions and comparisons of the two systems along with development and installation costs for the 1965-1975 fiscal years by OPN, O+M, N and MILCON categories. Conclusions regarding the utilization of the two systems are stated. (Author)

325. Custer RLP and Wahle K
DISTRIBUTION OF WATER THROUGH A VERTICAL PLANE FROM AUTOMATIC SPRINKLER HEADS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-920, 48 pages, Dec 1975
Availability: NTIS PB-248 913/6GA

An investigation was conducted to evaluate the distribution of water through a vertical plane from automatic sprinkler heads as a function of water discharge rate and sprinkler spacing. Tests were conducted to simulate discharging an automatic sprinkler head in a corridor to determine the effectiveness of the sprinkler head in covering a doorway with water spray when positioned at various locations. Major differences in distribution characteristics between sprinkler heads produced by different manufacturers were observed. It was determined that only sprinklers installed on the centerline of the doorway and discharging water at a flow rate of 20 gallons-per-minute or more would cover the top of the doorway. (Author)

326. Viets H, Balster D and Toms HL, Jr
FEASIBILITY STUDY OF UNSTEADY FOAM GENERATORS. Wright-Patterson AFB, OH, DoD Aircraft Ground Fire Suppression and Rescue Office; DoD AGFSRS-75-6, 45 pages, Dec 1975
Availability: NTIS AD-A021 485/8GA

A feasibility study was performed to examine the potential of employing an unsteady jet as the primary element in an aircraft fire suppression foam generator. The unsteady jet was controlled by fluidic means and contained no moving parts. Test results indicate an improved spreading rate of the unsteady jet and the possibility of producing a substantial amount of foam without contact between the primary flow and the mixing chamber walls. Further full scale tests are recommended. (Author)

327. Iden DJ and Reeves JB
AIRFIELD PARAMETER STUDY AND CATEGORIZATION SYSTEM RELATED TO AIRCRAFT GROUND FIRE SUPPRESSION AND RESCUE. Dayton Univ Res Inst, OH; DoD AGFSRS-75-1, 125 pages, Jun 1975
Availability: NTIS AD-A014 225

This report presents a discussion of the characteristics of airfields/helicopter pads which are related to the aircraft ground fire suppression and rescue (AGFSR) operation at DoD installations. The basic elements of the AGFSR system are described and a plan for rating airfields/helicopter pads according to their AGFSR needs is presented. The principal factor in the system is the maximum representative fuel fire area which is a direct function of aircraft fuel capacity. (Author)

328. McNamara WJ
GENERAL AIRBORNE FIRE SUPPRESSION SYSTEM. FINAL TECHNICAL REPORT, DEC 1970-JUN 1973. Army Mobility Equipment Res and Development Center; DoD AGFSRS-75-2, 70 pages, May 1975
Availability: NTIS AD-A014 226

This report describes the development, design, fabrication, installation and testing of a generic airborne fire suppression system. This was an experimental device specifically designed to permit inflight operation for testing and evaluation of suppressing and/or extinguishing aircraft crash ground fires from a hovering UH-1H helicopter. (Author)

329. Alger RS, Laughridge FI, Wiltshire LL, McKee RG and Johnson WH
EFFECTIVENESS OF OVERHEAD SPRINKLER SYSTEMS FOR EXTINGUISHING FIRES ON HANGAR DECKS AND IN VEHICLE STOWAGE COMPARTMENTS. Nav Surface Weapons Center, White Oak Lab, Silver Spring, MD; NSWC WOL TR-75-153, 93 pages
Availability: NTIS

The capacity of existing overhead foam dispensing sprinklers to extinguish fires shielded by aircraft and/or vehicles was measured under the crowded conditions encountered on hangar decks and in ships holds. Simplified shadowing geometries were used in a series of 10-foot-diameter JP5 fires extinguished with AFFF at application rates ranging from 0.16 to 0.22 GPM ft(-2). Findings from these model fires were confirmed in a series of 40 foot by 40 foot fires under full sized trucks and aircraft wings.

Until the flames are knocked down, a substantial fraction of the agent is lost in the fire plume; however, the extinguishment time is controlled primarily by the rate of foam migration under the aircraft and vehicles. The existing sprinklers extinguished the burning JP5 and would provide protection for the ship, but aircraft in the flames will suffer serious damage before the fire can be extinguished from overhead. The migrating foam does not cover or extinguish shielded combustibles that extend above the liquid fuel; consequently, the many tires on the stowed vehicles continued to burn and, unless extinguished by hand lines or other means, soon reignited the JP5. In order to prevent damage to aircraft and vehicles, additional applicators are required to apply agent directly to the seat of the fire. (Author)

330. Petrella RV and Frick HR
MECHANISM OF EXTINGUISHMENT OF JET FUEL FIRES. Dow Chemical Usa, Midland, MI, Contract Projects Lab; N00019-75-C-0172, 60 pages, 1975
Availability: NTIS AD-A022 706/6GA

This study is an attempt to examine the mechanisms by which halogenated hydrocarbons, such as trifluorobromomethane (CF3Br) and methyl bromide (CH3Br), function as fire extinguishants in a hydrocarbon combustion situation. The hydrocarbon fuels used in this study are n-pentane and cyclohexane. The technique of kinetic spectroscopy coupled to a spark ignition bomb is used to obtain combustion of the fuels in air or oxygen and to resolve the absorption spectra of the combustion intermediates as a function of time during the burning of the fuels. Combustion duration ranges from a few hundred microseconds (microsec) to several milliseconds (msec). The final products of combustion are determined by chromatographic separation. (Author)

331. Bright RG
REPORT OF FIRE TESTS ON EIGHT TGS SEMICONDUCTOR GAS SENSOR RESIDENTIAL FIRE/SMOKE DETECTORS. Nat Bureau of Standards, Inst for Applied Technol; NBSIR 76-990, 17 pages, Apr 1976
Availability: NTIS PB-251 769/6GA

At the request of the Bureau of Engineering Sciences, Consumer Product Safety Commission, twenty-four Taguchi gas sensor (TGS) detectors, representing eight manufacturers were tested to the requirements of Section 22 (base sensitivity tests) and Section 24 (full-scale fire tests) of Underwriters' Laboratories Standard No. 217, 'Standard for Single and Multiple Station Smoke Detectors.' Two conventional single-station smoke detectors, one an ionization chamber type and the other a photoelectric type, were included in the test series for comparison. The results are reported. (Author)

5. FIRE PROTECTION PRINCIPLES
g. Suppression Devices and Equipment

332. Sarkos CP
CHARACTERISTICS OF HALON 1301 DISPENSING SYSTEMS FOR AIRCRAFT CABIN FIRE PROTECTION. Nat Aviation Facilities Experimental Center; FAA NA-74-59, FAA RD-75-105, 114 pages, Sep 1975
Availability: NTIS AD-A017 061/3GA

Two halon 1301 dispensing systems, modular nozzle and perforated tube, were designed and installed in an obsolete but completely furnished CD7 passenger cabin. For each system, agent distribution was continuously measured during discharge and for a period of 10 minutes at approximately 20 locations throughout the unpressurized cabin. The effect of Halon 1301 discharge on cabin temperature, noise, pressure, and visibility was also measured. The modular system was judged to be best by virtue of its producing more rapid and effective agent distribution resulting in greater potential fire-protection capability. Installation of dispensers along the ceiling for both systems minimized the known possible transient adverse effects upon passengers from agent concentration overshoot, discharge noise, over-pressure, and reduced temperature. (Author's Abstract)

333. Krasner LM, Fitzgerald PM and Breen DE
FIRE PROTECTION OF LARGE AIR FORCE HANGARS. Factory Mutual Res Corp; FMRC 22445, AFWL TR-75-119, 60 pages, Oct 1975
Availability: NTIS AD-A017 545/5GA

This report describes a study related to the fire protection of large aircraft hangars. The study directly develops and augments a previous effort completed for the Air Force Weapons Laboratory in April 1974. This report discusses the attenuation of aqueous film-forming foam (AFFF) in a hot environment, foam particle fire plume penetration, supplementary low-level foam systems, floor drainage systems and draft curtains. In addition, 900 sq ft JP-4 fuel fire test results are discussed. The tests were the major effort of the program and were intended to evaluate the general effectiveness of 3 percent AFFF when discharged singly and together from overhead and ground level. The results of the study discussed in this report indicate that FC-203 is an extremely effective deluge system agent when applied at design densities of 0.16 gpm/sq ft but dramatically loses effectiveness when applied at the rate of 0.125 gpm/sg ft. At an application rate of 0.1 gpm/sq ft an oscillating monitor nozzle is capable of achieving 90 percent fire control in 30 to 45 sec under optimum conditions, a performance capable of aircraft protection. The potential for large reduction in water demand with no sacrifice to fire fighting effectiveness exists with closed heat AFFF sprinkler systems in hangars, as contrasted with AFFF deluge systems. (Author's Abstract)

334. Nash P
FIRE PROTECTION OF FLAMMABLE LIQUID STORAGES BY WATER SPRAY AND FOAM. Building Res Estab (UK), Fire Res Station; BRE CP-42-75, 19 pages, Apr 1975

Low-expansion fire-fighting foam differs fundamentally from other agents such as water spray, dry powders and inerting gases when applied to flammable liquid fires, in that it provides a high degree of protection against reignition for a considerable time after application. The other agents are usually only effective while they are being applied, and if complete extinction is not achieved in all areas, the fire can reflash over the whole exposed surface of the flammable liquid. However, there are exceptions to this rule, such as when water spray cools a flammable liquid well below its fire point.

This paper describes the control and extinction of flammable liquid fires by water sprays. It discusses the differences in the mode of extinction of the three main classes of liquid, and the essential design parameters of the equipment of each type. Some account is given of the extinction of 'mixed' fires involving flammable liquids and heated solids, such as surrounding metal structures, and of the protection of exposed equipment against the effects of radiant heat from adjacent flammable liquid fires. (Author's Abstract)

335. Richards CG
ASSESSMENT OF FLUID MECHANICS DATA FOR FIRE PROTECTION STUDY. Univ of New Mexico, Eric H Wang Civil Eng Res Facility; AFWL TR-75-102, 32 pages, Oct 1975
Availability: NTIS AD-A017 610/7GA

The fire protection systems in warehouses at Hill, Kelly, McClellan, Robins, and Tinker Air Force Bases were studied. Twelve different sprinkler system configurations were analyzed using a numerical technique, and the performance of the systems after being retrofitted with 0.64-in orifice sprinkler heads was predicted. The numerical results for buildings 380 and 385 at Robins Air Force Base and for buildings 10, 18 and 412 at Tinker Air Force Base were used as the standard reference values in determining whether or not other systems would give adequate protection when retrofitted with the 0.64-in orifice heads. The results are reported.

336. Johnson GA and Forshey DR
AUTOMATIC FIRE PROTECTION SYSTEMS FOR LARGE HAULAGE VEHICLES. PROTOTYPE DEVELOPMENT AND IN-MINE TESTING. Bureau of Mines, Twin Cities Mining Res Center; BuMines IC-8683, 21 pages, 1975
Availability: NTIS PB-246 704/1GA

The Bureau of Mines, through research and development contracts with the FMC Corp, has developed and tested two automatic fire-sensing and suppression systems for large haulage vehicles. One automatic truck fire protection system protects both the engine compartment and brake grid areas, while the second system is used in the engine compartment/fuel tank area. Both systems have redundant firesensing capabilities and manual override controls. Upon sensing flames and/or heat, the systems suppress the fire with pressurized, B-C class dry chemical. Both fire protection systems are flexible in design, and can be modified for use on other mobile mining equipment. Prototypes of both systems have been subjected to long-term, in-mine validation testing. Color illustrations reproduced in black and white.

337. Kung H-C
RESIDENTIAL SPRINKLER-PROTECTION STUDY. Factory Mutual Res Corp; FMRC 22442, 111 pages, Nov 1975

A research program was initiated to study sprinkler control of residential fires by the cooling mechanism in support of the development of design criteria for residential sprinklers.

A test room was constructed, 10 ft x 12 ft x 8 ft high, with window and a door leading to a simulated hallway.

Hexane pool fires were selected to simulate source fires. The key parameters of investigation were water-discharge rate and drop size. Other variables, such as the strength and location of the fire source, the degree of ventilation, and the sprinkler-operation time have also been explored. Test results show that as the median drop size decreases at constant discharge rate, an increasing degree of reduction is observed in the following quantities: 1) heat-release rate of the fire, 2) convective heat flux through the room opening, 3) ceiling temperature, 4) gas temperature inside the room, and 5) outflow gas temperature. The results also show that the higher the discharge rate, the greater the cooling. A correlation has been established between the heat-absorption rate by the sprinkler water and the relative median drop size of the sprinkler spray. The ratio of the heat-absorption rate to the heat release rate, normalized with the water discharge rate, varies as the minus -0.68 power of the relative median drop size.

A realistic bedroom fire test with flaming ignition was conducted to evaluate the optimum water discharge rate and sprinkler-orifice diameter determined in the pool-fire tests. The result demonstrated that the suggested optimum sprinkler discharge conditions are capable of 1) controlling a realistic bedroom fire, 2) protecting the structure of the fire room, 3) eliminating the possibility of fire spread to the rest of the building, and 4) providing life safety protection for the fire situation investigated, as judged from gas temperature and carbon monoxide measurements.

In order to contribute further to design criteria for residential sprinklers, the program requires extension to systematic studies with realistic fuels. (Author's Abstract)

338. Corrie JG
PROBLEMS WITH THE USE OF FIRE-FIGHTING FOAMS. Building Res Estab (UK), Fire Res Station; BRE CP-25-75, 9 pages, 7 figs, 9 refs, Mar 1975

Attention is focussed on why, when fires are extinguished with foam, the quantity of foam required increases progressively as the application rate is increased. Popular explanations are examined, some new experimental evidence is given, and a new explanation is proposed. (Author's Abstract)

6. FIRE SAFETY

a. AGRICULTURE AND FORESTRY

[For more complete coverage of the forest fire literature see Forest Fire Control Abstracts (Canada).]

339. Kazakov MV, Karpov VI and Matsuk MA
SUPPRESSION OF PEAT FIRES WITH SOLUTIONS OF SURFACTANTS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 100-108
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The use of surfactants to extinguish peat fires makes it possible to increase the water saturation of peat by a factor of up to 10 and to reduce the extinction time by a factor of up to 4-5. The reliability of the extinction measures is increased also. The characteristics of the surfactants recommended for use are given. (Author)

340. Deeming JE and Brown JK
FUEL MODELS IN THE NATIONAL FIRE-DANGER RATING SYSTEM
J For, 73(6):347-50, 1975

Fuel models were developed to provide data required by the mathematical fire behavior model which is the basis for the Spread and Energy Release Components of the National Fire Danger Rating (NFDR) System. The fuel models quantitatively describe those physical and chemical properties of fuel elements and fuel beds that govern flammability. Thus far, nine models representing broad vegatative types have been developed for rating fire danger. 2 figs, 2 tables, 25 refs. (Author's Abstract)

341. Furman RW
ESTIMATING MOISTURE CONTENT OF HEAVY FOREST FUELS
For Sci, 21(2):135-9, 1975

The specification of moisture contents in forest fuels is an integral part of any workable fire-danger rating system. This paper presents a linear model for estimating the moisture content of the 100-hour timelag fuel moisture, today's observed 10-hour timelag fuel moisture and a binary variable which is set if rain has occurred in the 24 hours prior to the observation time. The standard error of estimate for a data set of 69 points including 25 days during which some precipitation occurred was 0.65 percent. (Author's Abstract)

342. Haines DA, Johnson VJ and Main WA
WILDFIRE ATLAS OF THE NORTHEASTERN AND NORTH CENTRAL STATES. North Central Forest Experiment Station; FSGTR NC-16, 31 pages, Jan 1976
Availability: NTIS PB-248 755/1GA

The report describes patterns of forest fire activity across the northeastern and north central United States. It gives average dates of greening and curing of herbaceous plants, median size of fires in various fuels, and annual profiles of peak fires activity. It also examines combinations of major fire cause and day-of-week activity. (Author's Abstract)

343. Bussey AH and Harrington JJ
MODULAR AIRBORNE FIRE FIGHTING SYSTEM (MAFFS). FMC Corp, San Jose, CA; AFWL TR-73-271, 66 pages, Jul 1975
Availability: MTOS AD-A013 179

An optimally designed palletized five-tank operational Modular Airborne Fire Fighting System (MAFFS) was developed to provide increased protection against losses from grass, brush, and forest fires. In addition, this system will enable the US Air Force to control forest fires on more than 600,000 acres of forests under Air Force managment. MAFFS disseminates forest fire retardants having a viscosity range between 1 and 5000 centipoise. By manually adjusting the discharge pressure flow rates of 9000 to 38,000 gal/min, ground deposition rates from 1 to 4 gal/100 ft sq are achieved. This palletized system is compatible with the C-130A, B, and E.

(Author)

344. Higer AL, Swayge LJ, Bancroft WL and Cordes EH
THE APPLICATION OF LANDSAT DATA FROM COLLECTION PLATFORMS AND LANDSAT IMAGERY FOR FIRE MANAGEMENT, EVERGLADES NATIONAL PARK, FLORIDA. PROGRESS REPORT. Geological Survey, Miami, FL; NASA CR-146363, 16 pages, Oct 1975
Availability: NTIS

345. Stevenson AE, Schermerhorn DA and Miller SC
SIMULATION OF SOUTHERN CALIFORNIA FOREST FIRES
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 147-155
Sponsor: The Combustion Inst

Wildland fire spread has been simulated using a computer model. Reasonable success has been achieved in matching computed results with the observed fire parameters. The model for this effort was based upon existing Forest Service submodels augmented with ancillary programs to process the fuel, terrain, and meteorological data collected from the selected fires. Refinements to the model were made based upon sensitivity studies of the numerous input parameters. The simulation runs performed during this study gave insight into the improvements required to employ the model operationally. 7 figs, 6 refs (Author's Abstract)

b. COMMERCIAL OCCUPANCIES

346. Eeenken HD
BEHAVIOR AND PROTECTION OF PEOPLE AGAINST FIRE HAZARDS IN HOTELS
VFDB Z, 24(3): 108-113, 1975 (German)

After discussing fire hazards of hotels and the behavior of people, the author outlines measures for protecting people in hotels, primarily the structure proper, then individual parts, such as doors, materials, partitions, etc. Also important are the operating installations such as furniture, cooking and heating facilities, refuse, welding, etc. The author presents some suggestions for the installation of fire alarms. (Author)

347. Stapelfeldt JP
FIRE PROTECTION IN NIGHT CLUBS AND DISCOTHEQUES
Fire Internat, 5(51):37-46, 1976 (English, French, German; Spanish abstract)

Stricter controls have been introduced for catering establishments in Germany which concentrate on three points. The first is to ensure escape routes by establishing requirements on means of escape, fixing a maximum limit on the number of guests allowed, reducing the rate of combustion of wall and ceiling coverings and providing for emergency lighting. The second point relates to protection of the surrounding area by establishing fire compartments - walls, ceilings and doors. The third point, protecting the premises, calls for the provision of extinguishing equipment, eliminating fire hazards, and installing heat and smoke extraction vents. The comprehensive legislation laid down in the regulations for public places and the draft of regulations for catering establishments and various other legal stipulations are discussed under headings corresponding to those of these three points on the basis of the case of Hamburg. 2 figs, 2 tables.

348. Karlsch D
FIRE PROTECTION IN NIGHTCLUBS AND DISCOTHEQUES. II.
Fire Internat, 5(51):48-52, 1976 (English, French, German; Spanish abstract)

The practical problems of fire protection in nightclubs and discotheques were dealt with by Stapelfeldt in part I of this report. This second part treats the movement and behavior of occupants of such premises. The Predtechenskiy-Milinskiy method of calculating evacuation movement and time is applied to the case of a fire in a Cologne discotheque which claimed three lives. A questionnaire addressed to survivors and the reports of the fire service investigations established the behavior, movement and evacuation routes. The evacuation time calculated by the above method was relatively short, short enough to allow total safe evacuation, but such a calculation is invalid under the unusual conditions created by a real fire, in which unpredictable reactions of people must be taken into account. 4 figs.

6. FIRE SAFETY
b. Commercial Occupancies

349. Ragot MR
FIRE PROTECTION OF A MODERN BUILDING: A CASE HISTORY
Fire Internat, 5(51):85-91, 1976 (English, French, German; Spanish abstract)

The fire protection provided for a new seven-story building in Paris, with five basement levels, strictly conforming to statutory requirements, is described. The aspects discussed are the security staff and control room, equipment, heat sources, communication networks, safety equipment, maintenance, staff training, and attitude of the building occupants. 2 figs.

350. Anon
COMPUTER SUITES - SOME GUIDANCE ON FIRE SAFETY REQUIREMENTS
Fire Prev, (113):13-16, 1976

The high sensitivity to abnormal temperatures and humidity conditions and the common use of PVC as insulation represent special fire protection problems for computers. Fire detection and extinguishing systems and the need to minimize the risk of fire outbreak are fundamental to the protection of computers. Safety practices with regard to precautions for computer tape, storage of paper and materials, handling of waste materials, cleaning, maintenance and repair, cabling and cable ducts, floor and ceiling voids, air-conditioning systems, staff training, alarm and evacuation procedures, and the adjacent occupancies are examined. 3 figs, 2 photos.

351. Breloer F
PREVENTIVE FIRE PROTECTION IN THE NEW CITY CENTER OF MARL
Brandschutz, 30(2):38-41, 1976 (German)

Shopping centers do not, in most cases, fit the well-delineated framework of codes for commercial buildings. At the present time there are no fire protection barriers for large widths that have been authorized by building inspectors and that would be acceptable from a fire protection standpoint (e.g., sealing off the mall from the commercial premises). The sizes of fire barriers for such malls cannot be maintained. The possibilities of using new building materials and components are open as long as doubts as to fire protection do not arise. All knowledge relating to preventive fire protection was applied in the city center of Marl. This will have a positive effect on protection of shoppers and will alleviate appreciably eventual work on the part of the fire-fighting service. 7 figs, 5 refs.

c. ELECTRICAL

352. Tsymbal VG and Dobko II
INTRODUCING WATER FIRE-EXTINGUISHING SYSTEMS IN CABLE DUCTS
Elektr Stn, (11):74-75, 1975 (Russian)

An important condition for reliable operation of power plants is the installation of effective cable-duct fire protection systems. Water fire-extinguishing systems have been installed because they are inexpensive, reliable, in place, and do not require constant operational expenditures. They have proved to be more effective in protecting cable ducts than other systems and have the advantage that their control can be automated. 1 fig. (Author)

353. Dunn JJ
WIRING NEGLECT SPARKS CONCERN
Fire Eng, 129(3):54,56,60-61, 1976

Electrical hazards are a common cause of America's staggering fire losses. Many easily recognized hazards can be corrected by familiarity with the National Electric Code. Common hazards are presented by extension cords, air-conditioners, poor maintenance, unmaintained circuit breakers, and corrosion of circuit breakers and fuses. 4 figs.

354. Buklan GI, Kudin VV and Kolenovskiy AS
ON THE USE OF ELECTRICAL EQUIPMENT IN FIRE-HAZARDOUS ASSEMBLIES (DISCUSSION)
Prom energ, (9):4-6, 1975 (Russian))

Every year 20-24 percent of the total number of fires is caused by faulty electrical equipment. It is proposed that the regulations for the technical use of electrical assemblies and the regulations on safety engineering in the use of electrical assemblies contain sections on the use of such equipment in fire hazardous assemblies. A number of requirements for reducing the probability of the occurrence of fire is given.

355. Anon
CABLE WITH FLAME-RESISTANT INSULATION
Elektrotech Z, B27(17):460, 1975 (German)

The SEL Co of West Germany has developed a polyvinylchloride material Stan-Noflam for the insulation sheath of electrical cables. This material differs from the existing materials by its low combusibility; it catches fire only when it is directly in the fire zone and stops burning when it is removed from this zone.

356. Anon
NEW EXPLOSION-PROOF ELECTRICAL EQUIPMENT
Bezop tr prom-sti, (8):49-50, 1975 (Russian)

357. Bondarev AG, Kotov AA and Fukalov VG
STUDY OF THE EFFECT OF HIGH-EXPANSION FOAM ON SHIPBOARD ELECTRICAL EQUIPMENT
Sb Tr VNII protivopozhar oborony, (5):84-88, 1974 (Russian)

Tests have verified the possibility of operating a 150 hp diesel generator in a compartment filled with high-expansion (1,000) mechanical foam.

358. Anon
FLAME RETARDANT PVC FOR INSULATION AND CABLE SHEATHING
Electr Commun, 50(3):210-211, 1975

The ITT system has developed and put into production polyvinyl chloride compounds for insulation and sheathing of wires and cables which have much lower flammabilities than conventional polyvinylchloride. 1 table.

359. Mombach J and Connell WM
SMOKELESS CABLE. Transit Development Co, Inc; TDC/500-74/2, 12 pages, Jun 1974
Availability: NTIS PB-241 850/7ST

The transit industry embarked upon a program to realistically and comprehensively develop an understanding of fire safety in the use of electrical wire and cable insulations and jacketing materials. The New York City Transit Authority has devoted extensive time and effort to identify the potential dangers. The fire safety problem concerned with excessive heat characteristics is described. (Author)

d. INDUSTRIAL OCCUPANCIES

360. Zozulya VM, Bespalyy IK, Loginov FL and Mileev EB
FIRE PREVENTION IN INDUSTRY AND AGRICULTURE (Pozharnaya Profilaktika v promyshlennosti i sel'skom khozyaystve)
Stroyizdat, Moscow; 387 pages, 1974 (Russian)

Methods of analyzing fire hazards in industry and agriculture are discussed in the book. Automatic systems which ensure the fire safety of industrial processes are described. The characteristics of readily combustible and combustible fluids and methods of protecting them from fire are presented. General information on fire-safety methods in the oil refining industry are given. This textbook is intended for students of the fire-engineering schools and can be used by fire service personnel. (Author)

361. Reilly TC
AUTOMATIC GAUGING OF FUEL STORAGE TANKS
Fire Eng J, 36(102):20-21, 1976

Two basic systems for automatic tank level control are presented and illustrated in diagrams. The first, a differential pressure system, is suitable for small tanks up to about 300 tons capacity; the level of fuel in the tank is sensed by measuring the difference in hydrostatic pressure caused by changes in fuel level. The second, a float sensor system, is used in large storage tanks; the sensor is used to transmit changes of level by means of a steel tape protruding through the roof to a readout head, a syncro-transmitter passing the readout to a remote dial located in a control center. 3 figs.

362. Anon
FPA GUIDE TO SAFE PRACTICE WITH FLAMMABLE LIQUIDS
Fire Prev, (114):23-30, 1976

Small quantities of flammable liquids are used daily in one form or another by almost every factory, representing a serious threat to life, business and property. This guide is intended for factories using quantities of flammable and highly flammable liquids too small for piping. Advice on fire safety is given under the following headings: the nature of flammable liquids, legislation, design of premises, dangerous practices, containers and decanting, precautions in production and process areas, disposal, and staff training. 1 fig.

363. Anon
HOW PERKINS ENGINES USE FIRE SAFETY TO REDUCE PRODUCTION LOSSES
Fire_Prev, (114):15-20, 1976

The fire protection of a high-performance diesel engine plant (UK) has been approached in three ways: by introducing a policy of total loss control, covering accident prevention and security as well as fire protection; by installing fixed fire detection and fire extinguishing systems whenever there is an appreciable fire risk; and by having a works fire brigade which is fully involved in all aspects of fire prevention as well as fire-fighting. 1 fig, 5 photos.

364. Anon
FPA GUIDE TO INDUSTRIAL FIRE SAFETY TRAINING
Fire_Prev, (113):21-28, 1976

Guidance to fire safety in factories is given with respect to overall responsibility, legal requirements, initial and long-term training, fire instructions, drills, first aid, fire precautions, training trainers, printed and visual aids, and sources of further information.

365. Grein W, Braubach H-O and Weisner D
TECHNICAL SAFETY AND CONVENIENT WORKING CONDITIONS IN CHEMICAL PLANTS
Chem-Ing-Tech, 48(4):281-287, 1976 (German)

On the basis of some examples from practical work, principles of a safety concept are developed which can be applied consistently in all major German chemical plants. Despite the latent hazards present in the chemical industry, application of these principles has succeeded in creating safe working conditions. It is shown that to solve the safety engineering problems the same tools can be used as are used to solve other engineering problems. It is pointed out that problems of safety and convenient working conditions in plants are closely interwoven and both goals can be achieved in the same way. 14 figs, 10 refs. (Author)

366. Peroni GC
FIXED FIRE PROTECTION SYSTEMS IN PLANTS MANUFACTURING VARNISH PRODUCTS AND PRINTING INKS
Ind_Vernice, 29(10):2-25, 1975 (Italian)

After defining the general terms of the fire security problem, the author discusses the structural and functional principles of fixed protection systems from the standpoint of reliability, criteria for selecting the protection system suitable for the activity being protected, the general regulations governing the design, construction, installation and maintenance of protection systems, and the developmental tendencies for technical standards, both national and international. In the course of a conclusive examination of the advantages offered by fixed systems as compared to the possibility of direct and indirect damage and the civil and legal responsibility of the plant, these advantages are compared with the required investments, the problem of amortization, and the insurance costs. The paper continues with a more detailed examination of individual fixed protection systems, illustrating their technological features, design criteria, operational optimization and factors suitable for the environment being protected. (Author)

367. MacCarthy BJ
STANDARDS FOR INDUSTRIAL FLAMEPROOF LIGHTING
Electron_Power, 21(21/22):1187, 1975

The principle of containing electrical apparatus within an enclosure of sufficient strength to withstand an internal explosion without igniting an explosive mixture outside the enclosure has been used for many years. BS 229, 'Flameproof enclosure of electrical apparatus', was first published in 1926, and, with four revisions and numerous amendments, served British industry so well that it was adopted by countries throughout the world. Subsequent changes are discussed. (Author)

368. Isimura Yu
FIRE SAFETY OF OXYGEN COMPRESSORS AND LIQUID PUMPS
Koatsu___gasu, 12(6): 247-253, 1975

(Japanese)

A report is made of the basic tendencies in the development and improvement of fixed oxygen compressors and liquid pumps used in Japanese industry as well as of the organizational steps being taken to improve their fire safety. The codes in force in the US, Great Britain and Japan are discussed in detail, as are the regulatory steps. The industrial process of fabricating parts and assembling oxygen compressors and liquid pumps are also being reviewed in the interest of increased fire safety. It is noted that the main target of improvement and control are the automatic thermal control instruments, temperature sensors, safety manometer assemblies, etc. The stability of the operating parameters and the operational safety depend on these instruments, and therefore particularly rigid demands are made on their reliability and accuracy.

369. Anon
FIRE PROTECTION AND FIRE FIGHTING IN A LARGE INDUSTRIAL ENTERPRISE
Tech_Mod, 67(10):39-40, 1975 (French)

The fire protection measures taken by a large wool processing plant are described. The measures consist in the establishment of fire inspection, watch and fire-fighting teams; the installation of fire detection and alarm systems; distribution of fire-fighting equipment; removal of fire hazards; compartmentalization of the plant facilities; erection of fire barriers; arrangements for evacuation routes, etc.

370. Bussenius S
RELIABILITY OF PROCESSING EQUIPMENT FROM THE VIEWPOINT OF FIRE AND EXPLOSION RISKS
Chem_Tech, 28(2):98-102, 1976 (German)

Fire prevention and fire safety of employees in modern chemical plants require close scrutiny of the fire and explosion hazards of the processing equipment. In the planning of methods and equipment attention should be focussed on recognition of the critical spots in order to avoid the occurrence of the extreme conditions by taking informed measures to stabilize and eliminate weak points or, if this is not possible, to specify in advance suitable protection measures by analyzing the indicators and causes for the appearance of such situations. 7 figs, 5 refs. (Author)

371. McGary RA
FORMING A BRIGADE FOR FIRE PROTECTION IN INDUSTRIAL PLANTS
Fire_Eng, 128(5):32,34-5, 1975

Aspects of firefighter training for industrial fire brigades and the basic conditions for forming brigades are considered. Recruiting requirements are given as well as specific training program features. 5 figs.

372. Roberson EC
MONITORING THE FLAMMABILITY OF MATERIALS USED IN THE TELECOMMUNICATIONS AND POWER INDUSTRIES
Telecommun_J, 42(11):660-2, 1975

A flammability test apparatus, which measures the critical oxygen index of combustible materials to 0.1 per cent, is used in quality control of materials required for insulating or containing electrical cables and components. Plates and diagram illustrate apparatus.

e. MINING

[For more complete coverage of the mining literature see SMRE_Safety_in_Mines Abstracts (UK).]

373. Orlov VN and Charkov VP
USE OF AN INERT MECHANICAL GAS FOAM TO EXTINGUISH UNDERGROUND FIRE IN GASSY MINES
Foams._Production_and_Application._Papers of_the_All-Union_Scientific_and_Technical Conference._Part__2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 141-144
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

A foam generator has been developed at the All-Union Mining Research Institute in which the foam bubbles are filled primarily with nitrogen. The oxygen content in this foam is 0-15.4% and is regulated as a function of the explosivity of the methane-air mixture in the mine atmosphere. (Author)

6. FIRE SAFETY
e. Mining

374. Rybalko SF and Kushnarev AM
CALCULATION OF THE TIME REQUIRED TO FILL VERY LONG DEAD-END MINE WORKINGS WITH FOAM
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3; 1974, All-Union Fire Protection Res Inst, Moscow, pages 67-69
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

A formula is given for determination of the time required to fill dead-end mine workings with foam. A table is compiled to compare the time needed to fill a nozzle with foam, as obtained in tests and as calculated by the formula. (Author)

375. Kozlyuk AI, Grin GV and Metal'nikov VO
FIRE SUPPRESSION IN MINE WORKINGS EQUIPPED WITH BELT CONVEYORS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3; 1974, All-Union Fire Protection Res Inst, Moscow, pages 70-72
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

A theoretical determination is made of the length of a working that can be protected by one foam generator of a given capacity. (Author)

376. Karataev AK
EXTINGUISHING FIRES IN MINES OF THE ROSTOV REGION USING A MECHANICAL FOAM, pages 86-96
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3; 1974, All-Union Fire Protection Res Inst, Moscow
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

In mines of the Rostov region 5 percent of the fires are extinguished with mechanical foam. Examples of fires are given in which the use of foam played a decisive role in their suppression. A calculation is made of the quantity of foam required to reduce temperature to normal. (Author)

377. Kozlyuk AI, Ponchik SKh, Popov VA, Vasilenko VV and Vishnevskiy LD
STUDY OF THE TIGHTNESS AND FIRE HAZARDS OF SEALING GASKETS OF PNEUMATIC MINE DUCTS
Gorno spasat delo, (10):33-37, 1975 (Russian)

A new design for a shaped sealing gasket has been developed at the All-Union Mining Res Inst. It has been found that irregularly shaped gaskets made of any kind of rubber, in contrast to flat gaskets, are characterized by high sealing properties and completely eliminate heating when compressed air leaks occur. (Author)

378. Khorol'skiy VT, Velik IP and Lysenko EP
FIRE-HAZARD ZONES IN THE WORKED-OUT SPACE OF STEEP DOWNWALLS
Gorno spasat delo, (10):42-44, 1975 (Russian)

The most dangerous zones from the standpoint of probability of fire occurrence are determined. It is shown that, from the viewpoint of preventing endogenic fires, stripping of the forward intermediate cross-cuts is no more advantageous than stripping the rear ones. Nevertheless, stripping the rear intermediate cross-cuts reduces the explosion hazard of methane-air mixtures in the worked-out space and increases the possibility of active fire suppression. (Author)

379. Van der Walt NT
NEW WAYS OF DETECTING UNDERGROUND FIRES PROVE THEIR WORTH IN SOUTH AFRICA MINES
Eng Min J, 177(2):80-5, 1976

An effective fire detection and early warning system has been developed for deep-level South African gold mines using large amounts of timber for roof support. This major project, which includes detectors, analyzers and telemetering transmitters in the system, is described, as are the results it achieved. 8 figs.

380. Anon
SEALANT SYSTEM REDUCES MINE FIRE HAZARDS
Eng Min J, 176(9): 119, 1975

A system consisting of a wheel-mounted mixer and compressor for applying a fireproof oxy-cement mine sealant to fireproof and reinforce rock surfaces in underground mine tunnels is being marketed by American Brattice Cloth Corp. Mixing and spraying operations are combined in a single compact, portable machine powered by an electric motor.

381. Berry DR, Maser K, Monaghan DA and Guzdar AR
EXTINGUISHING COAL MINE FIRES BY REMOTE SEALING. VOL I. OPERATIONS MANUAL. Foster-Miller Assoc, Inc; BuMines OFR-77(1)-75, 97 pages, Sep 1973
Availability: NTIS PB-245 898/2GA

The operations manual describes basic procedures and system specifications for the remote sealing system developed under the contract. The objective of the system described in the manual is to extinguish coal mine fires by remote sealing of the underground passageways. The system developed is versatile enough to function under a wide range of operating conditions including large variations in passageway geometry, depth of mine, water conditions both in the mine and at the surface, and rubble in the mine passage. The system includes instrumentation for the remote probing of the passageway prior to sealing, a system for sealing the mine passages and instrumentation for remote monitoring of the quality of the seal during and after construction.

382. Berry DR, Maser K, Monaghan DA and Guzdar AR
EXTINGUISHING COAL MINE FIRES BY REMOTE SEALING. VOL II. TECHNICAL REPORT. Foster-Miller Assoc, Inc; BuMines OFR-77(2)-75, 507 pages, Sep 1973
Availability: NTIS PB-245 899/0GA

Techniques were developed and demonstrated for extinguishing coal mine fires by remote sealing of the underground passageways. The system is versatile enough to function under a wide range of operating conditions including large variations in passageway geometry, depth of mine, water conditions both in the mine and at the surface, and rubble in the mine passage. The system includes instrumentation for the remote probing of the passageway prior to sealing, materials and equipment for sealing the mine passages, and instrumentation for remote monitoring of the quality of the seal during and after construction. (Author's Abstract)

383. Warner BL
EVALUATION OF POTENTIAL FIRE HAZARD CAUSED BY EXPOSED TIMBER IN MINE PASSAGEWAYS. Kidde (Walter) and Co, Inc; BuMines OFR-83-75, 60 pages, 3 Mar 1975
Availability: NTIS PB-245 903/0GA

The research involved testing to determine whether a fire hazard existed when the exposed wood surface area of timber in a mine passageway equals 40 percent of the surrounding strata surface, excluding the sill. Twelve full-scale fire tests were conducted in a simulated mine passageway, using kerosene pan fires as the ignition source. The tests included three timber sizes, plus one test with roof lagging, two wood types, plus one test with treated timbers, and two ventilation air velocities. The results showed that air velocity was an important factor in the occurrence of flame propagation and that 40 percent surface area ratio of wood to surrounding strata appeared to be a valid criterion for fire safety at 150 fpm, but not at 350 fpm. (Author's Abstract)

384. Lease W
DEVELOPMENT AND TESTING SERVICES OF A FIRE PROTECTION SYSTEM FOR COAL AUGERS. Lease 'AFEX', Inc, Raleigh, NC; BUMINES OFR-25-76, 16 pages, Oct 1975
Availability: NTIS PB-249 865/7GA

The objective of this study was to determine and define fire hazard problems common to a surface coal mine auger and install upon it a fire sensing and fire suppression system. This study successfully accomplished its objective and as a result of this project such protective systems are being voluntarily installed on coal auger machines. (Author)

385. Gregory CE
AN ANNOTATED BIBLIOGRAPHY OF MINE FIRES. Idaho Univ, Bureau of Mining Res; UI BMR-13, BUMINES OFR-29-76, 374 pages, Jun 1974
Availability: NTIS PB-250 540/2GA

The bibliography includes an annotated reference for each article or report cited, underlining the cause, extent, methods used, procedural errors made, results achieved, ventilation effects, and lessons learned from the operation of subduing the particular fire. References associated with mine fire prevention, protection, causes, sources, equipment for subduing fires, rescue work, damage assessments, and fire detection are covered. (Author)

386. Warner BL
SUPPRESSION OF FIRE ON UNDERGROUND COAL MINE CONVEYOR BELTS. Walter Kidde and Co, Inc; BUMINES OFR-27-76, 111 pages, Sep 1974
Availability: NTIS PB-250 368/8GA

The program involves the evaluation of means for suppressing fires on underground coal mine conveyor belts. Full-scale conveyor belt fire tests were conducted to determine the requirements of automatically actuated water sprinkler, high expansion foam, and multipurpose dry powder extinguishing systems, and of various fire detection devices, necessary to adequately protect underground belt heads. The program included the development of a suitable full-scale conveyor belt test fire, conducting of fire tests in which extinguishing and detection systems and equipment were evaluated, and testing to evaluate the effects of the coal mine environment on detection equipment. Preliminary testing conducted to develop a suitable test fire revealed that fire can propagate on some conveyor belting classified as fire resistant. New fire-resistant PVC and new nonfire resistant rubber belts were used in the full-scale fire tests. These tests indicated that a single branch line sprinkler system with relatively low water pressure provides adequate belt head protection.

387. Maser KR, Wallhagen RE and Dieckmann J
DEVELOPMENT OF A FLY-ASH CEMENT MINE SEALING SYSTEM. Foster-Miller Associates, Inc, Waltham, MA; BUMINES OFR-26-76, 115 pages, Mar 1975
Availability: NTIS PB-250 611/1GA

This report describes the development of a system which modifies an existing fly ash-foam remote mine sealing technique to make it capable of impounding water in a fire zone. Laboratory-scale determinations were made of the capillarity, permeability, shrinkage, and shear strength of various mixtures of fly ash, bentonite, lumnite, and cement. Leakage tests (1/4 scale) indicated that shrinkage in the fly ash-cement mixtures always results in leakage, whereas fly ash-bentonite mixtures were impervious to water. Large-scale leakage tests with a 15-foot water head showed that a 1:1 fly ash-bentonite bulk seal with a 2-inch top layer of 1:1 fly ash-Huron cement is the optimum combination for a water-tight seal; a froth foam topping is suitable for providing an air-tight seal. A water leakage rate of about 1.5 gpm is predicted for the optimum combination of the above sealants in a typical mine with a 15-foot water head. Guidelines are given for determining the quantities of materials required for constructing a mine seal. (Author)

388. Greuer RE
STUDY OF MINE FIREFIGHTING USING INERT GASES. Michigan Technol Univ, Houghton Coll of Eng; BUMINES OFR-15-76, 223 pages, Oct 1974
Availability: NTIS PB-249 340/1GA

A theoretical evaluation was made of the usefulness of fighting coal mine fire with inert gases. A review is made of existing applications that indicate that inert gas methods of fighting mine fires are routine in Czechoslovakia and the USSR. Details are given of the calculation of inert gas requirements. If sudden ventilation changes can be avoided, the main inerting requirements are to prevent explosion hazards from methane, which is normally liberated in the mine. However, sudden ventilation changes during a fire complicate the inerting requirements owing to possible formation of flammable distillation products. Inert gas methods are considered for the prevention of explosion when fires are fought directly, during construction of seals and for extinction of mine fires. Calculations of the inerting requirements are presented and compared with observed data from actual applications. In some instances, it is believed that the use of inert gas could reduce sealing time requirements by an order of magnitude. (Author)

389. Grumer J
RECENT RESEARCH CONCERNING EXTINGUISHMENT OF COAL DUST EXPLOSIONS
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 103-114
Sponsor: The Combustion Inst

Current practices of protection against coal dust explosions propagating through mines are examined and found to be basically methods of cooling flames below the temperature limits for flame propagation. Such is the case with rock (stone) dusting and with passive barriers (extinguishant dispersed by the explosion) using rock dust or water. Chemical fire extinguishants such as sodium and potassium compounds used in recent research seeking to develop triggered barriers (extinguishant dispersed by a contained energy source on signal from a flame detector) do not appear to have a great advantage over thermal quenching agents. 2 figs, 8 tables, 63 refs (Author's Abstract)

390. Richmond JK and Liebman I
A PHYSICAL DESCRIPTION OF COAL MINE EXPLOSIONS
Combustion Symp, 15th Internat, Proc; 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan, pages 115-126
Sponsor: The Combustion Inst

Among the many hazards of underground coal mining, explosions of natural gas and coal dust continue to pose a threat, in spite of advances in safety practices. The US Bureau of Mines has conducted research in the causes and prevention of coal mine explosions in its Experimental Mine. As a result of extensive instrumentation of this fullscale facility and systematic analysis of results, a physical description of coal mine explosions is presented, with emphasis upon unsteady fluid dynamics. In a single long entry, useful correlations are shown between flame speed, particle velocity, and static pressure rise. How this knowledge may be applied to the design and application of explosion barriers is presented and the role of coal volatiles in dust explosions is briefly discussed. 9 figs, 9 refs (Author's Abstract)

f. POWER PLANTS

391. Zitzmann H
FIRE-PROTECTION IDEAS FOR POWER PLANTS
BBC-Nachr, 57(8/9):487-492, 1975 (German)

The problems involved in optimal fire protection of thermal electrical power plants are discussed. It is emphasized that all the power plant assemblies must have the same level of fire safety. A recommended sequence of solutions of problems involved in the design of fire-safe power plants is considered, beginning with the selection of suitable materials and ending with the design of automatic fire protection systems. Information on fire statistics is presented, showing that the largest number of fires occurs during installation, adjustment and operation of the equipment. 2 figs.

392. Collins HE, Levine S, Minners W, Moore VA and Panciera VW
RECOMMENDATIONS RELATED TO BROWNS FERRY FIRE. Nuclear Regulatory Commission; NUREG-0050, 94 pages, Feb 1976
Availability: NTIS PB-249 674/3GA

The sequence of events during and subsequent to the fire at the Browns Ferry nuclear plant is delineated. The impact of the fire on the health and safety of residents in the Browns Ferry locale is evaluated. The Special Review Group makes recommendations to be implemented by the Nuclear Regulatory Commission relating to fire-preventing systems and emergency plans at both Browns Ferry and other nuclear power plants, and for future license-application evaluations. (Author)

393. Anon
ANNUAL TECHNICAL PROGRESS REPORT, NUCLEAR SAFETY CHARACTERISTICS OF SODIUM FIRES AND FAST REACTOR FISSION PRODUCTS, GOVERNMENT FISCAL YEAR 1975. Atomics Internat Div, Canoga Park, CA; AI ERDA-13155, 53 pages, Aug 1975
Availability: NTIS AI ERDA-13155

Progress is reported in the areas of sodium jet dispersal tests, stationary sodium drop tests, SOMIX code development, buoyant bubble rise tests, aerosol leakage, fuel and fission product release from burning sodium, and heat-temperature properties of fuel mixture.

g. PUBLIC BUILDINGS

394. Morris J
MANAGING THE LIBRARY FIRE RISK
Univ of Calif, Berkeley; 110 pages, 1975

This book is written for library managers, but would be of interest to fire chiefs concerned with the unusual problems of library fire protection. The author describes the special risks associated with libraries including the problems of the type of building construction and the possibility of a large loss. He recommends systems for detection and extinguishment, and points out the advantages of sprinklers that shut off the water when a fire is out. There is a case history of a library fire at Temple University in Philadelphia with a follow-up analysis. The analysis points out that "one sprinkler head" could have prevented the fire. The author also discusses the use of automatic Halon 1301 systems and recommends them for some library applications. A chapter on disaster planning suggests working with the local fire department in the planning process as well as in fire prevention inspections.

395. Heywang R
DEVELOPMENT OF FIRE PROTECTION REGULATIONS FOR PUBLIC BUILDINGS
Prot Civ Secur Ind, (245)):8-20, 1975 (French)

396. Yakovlev AI, Bushev VP and Levites FA
FIRE SAFETY OF RESIDENTIAL AND PUBLIC BUILDINGS
Sb Tr VNII protivopozhar oborony, (2):85-91, 1974 (Russian)

Various methods of fire-proofing steel structures used in the USSR and elsewhere are examined.

h. RESIDENTIAL OCCUPANCIES

397. Kornsand NJ
HIGH-RISE, AN ENDANGERED SPECIES
Soc Fire Protection Engineers; 1975

In this book, author Kornsand, Rolf Jensen and Associates, expresses his concern for restrictive codes for high-rise buildings in the future. Recently adopted highrise codes cannot be evaluated since there is little fire data to analyze objectively the effectiveness of the systems now required. Yet, code groups are considering more stringent requirements which may decrease the feasibility of highrise construction.

398. Foehl JM
IN QUEST OF AN ECONOMICAL, AUTOMATIC FIRE SUPPRESSION SYSTEM FOR MULTI-FAMILY RESIDENTIAL COMPLEXES
Fire J, 70(1):48,53-57, 1976

Ways and means to achieve reliable, effective, economical sprinkler systems for low-rise and medium-rise (8 to 12 stories or less) multi-family residential complexes based on competent engineering and design are explored. An eight-story highrise project was evaluated to illustrate the practicality and economic feasibility of the system design concept combining domestic water supply and an automatic fire sprinkler system using copper tube and fittings, resulting in price reductions of 16 percent. 5 figs, 1 table.

399. Davis S
RESIDENTIAL INTERIOR SOLUTIONS AND THEIR IMPLICATIONS FOR FIRE SAFETY. Univ of California (Berkeley), Fire Res Group; UCB FRG 75-6, 21 pages, 46 figs, 4 refs, Feb 1975
Availability: NTIS

The habits of consumers and the contents of their dwellings are not regulated by building codes and fire ordinances. It is necessary, however, to know the arrangements and configurations of materials, finishes, and equipment placed within a dwelling by various user groups to have a complete picture of the fire safety problem. This paper discusses the range of interior solutions and their implications for fire safety, covering emergent trends as well as traditional designs. These newer trends have more intensive space use due to limitations in available space and often use multi-functional objects constructed in synthetics. The Interior Framework Strategy suggested in this paper is an integral approach to both fire safety and interior design. The incorporation of extinguishing and detection equipment into space defining interior devices promises to improve fire safety and increase available interior forms. The conclusion of this paper suggests a multi-faced approach to fire safety combining technological devices, space defining equipment, testing, and communication of results to consumers and designers.

400. Crossman ERFW, Zachary WB and Pigman W
FIRRST: A FIRE RISK AND READINESS STUDY OF BERKELEY HOUSEHOLDS, 1974. Univ of California (Berkeley), Fire Res Group; UCB FRG WP 75-5, 20 pages, 10 tables,

1975

The need for an expanded database on household fire prevention and control is pointed out, and a novel survey technique presented. A geographically random sample of 3,500 households in 7 fire districts of Berkeley, California, was surveyed in May 1974, using a one-page questionnaire form. Information sought included 1) exposure rate for six types of fire related activity; 2) preparedness to deal with four types of residential fire; 3) availability of two types of equipment; 4) actual fire incidents experienced in the recent past; 5) opinions on fire-safety policy; and 6) selected respondent and household characteristics. One thousand four hundred eleven valid forms (40.3%) were returned, including 208 fire incidents (14.7% of returns), of which 99 (6.9% of returns) represented residential fires within the past year. These data were subjected to statisitcal analysis. The resulting picture of residential fire hazard, occupant preparedness, and opinion is outlined and discussed, together with their implications for fire protection policy of fire department and city agencies.

i. TRANSPORTATION (AIR, RAIL, ROAD, WATER)

401. Troy JJ
FIRE PROTECTION PROVISIONS FOR RAPID TRANSIT SYSTEMS
Fire J, 70(1):13-17, 1976

Several factors, ranging from interior vehicle finish to a disaster plan for coordinating efforts of public agencies, are involved in considering fire protection or fire life safety in the planning, design, construction, and eventual operation of a rapid transit system. The various factors, such as under-car area, car interior finish, the station, trackway, tunnels, and other aspects are discussed. The development of a code specifically designed for rapid transit systems is recommended. 4 photos.

402. Volkov OM
FIRE PROTECTION IN AVIATION
Pozhar okhrana, 1:94-154, 1974 (Russian)

The technical problems of reducing the fire hazard of aviation fuels and protecting aircraft fuel systems form explosion, of structural fire protection of passenger compartments and crew cabins, as well as the status and outlook for the development of firefighting equipment to extinguish aircraft ground fires in airports are examined. 19 figs, 14 tables, 112 refs. (Author)

403. Anon
FIRE PROTECTION OF SHIPS [POZHARNAYA ZASHCHITA SUDOV]
Sb Tr VNII protivopozhar oborony, (5) (Collection of Papers of the All-Union Fire Protection Res Inst); 123 pages, 1974, 40 kopecks (Russian)

This collection contains papers prepared at the Joint Res Lab of the All-Union Fire Protection Res Inst on structural and active fire protection and routine measures taken on ships. The individual papers are abstracted separately. See the source index for identification of the individual abstracts.

404. Fedotov MN, Sedin VM, Boronin YuA and Belash VD
INERT GAS SYSTEMS AS A RELIABLE PREVENTION MEANS ON BULK GAS CARRIERS
Sb Tr VNII protivopozhar oborony, (5): 107-112, 1974 (Russian)

Considered are inert gas systems to be used on ships to fill the space between the primary and secondary shells, the ship's hull and the filling shells, and to scavenge cargo compartments, as well as to extinguish fires. (Author)

405. Smirnov KP, Konyashev VI, Pavlov GP and Fedotov MN
RECOMMENDATIONS FOR THE STUDY OF SHIP FIRES
Sb Tr VNII protivopozhar oborony, (5): 113-121, 1974 (Russian)

In studying ship fires it is necessary to take into account heat transfer to adjacent compartments owing to the high thermal conductivity of the metal bulkheads. Parameters such as rate of propagaion of combustion, area of the fire, and gas transfer conditions must be determined. (Author)

406. Gavrikov NF and Pavlova LV
CALCULATION OF THE FIRE ENDURANCE OF SHIP DECKS
Sb Tr VNII protivopozhar oborony, (5):47-

64, 1974 (Russian))

407. Somov VP, Sidoryuk VM, Martynenko VI, Kiselev VF, Romanov EI and Ul'yanchenko NV
STANDARDIZATION OF THE QUANTITY OF COMBUSTIBLE MATERIALS IN THE LIVING QUARTERS OF OCEAN VESSELS
Sb Tr VNII protivopozhar oborony, (5):28-46, 1974 (Russian)

Standards have been developed for the combustible load which will conform to the basic principle of the 1960 international convention on the protection of human life at sea (MK-60), the limitation of fire spread through a ship. The standards were developed on the basis of experimental research. (Author)

408. Hiroshige I
RESULTS OF THE WORK OF THE TECHNICAL COMMISSION ON COMBATING FIRES IN RAILROAD TRANSPORTATION
Sharyo to Denki, 26(6):22-5, 1975 (Japanese)

From the results of work done in 1973-74 a partial analysis is made of the causes, circumstances, nature and possible effects of fires in trains. The potential fire sources are classified in categories; the major categories and causes are subdivided into external and internal. The external causes are from unextinguished cigarettes, lightning, other burning objects, e.g. tunnel fires or other railroad facilities. The internal causes are ignition by mineral oils, due to excessive increase in the temperature of the oil and other lubricating materials above a certain permissible threshold temperature, sparks as a result of friction, and other causes arising from structural features and the operating parameters of the engine, moving parts, etc. The most dangerous components and structural assemblies of the railroad complex are classified, in a fire sense, in great detail. Also presented is a logic scheme of the origin of fire centers, the development of a warning system, the inclusion of an automatic primary suppression system and subsequent steps in suppressing fires and their effects. The scheme is applicable to fire systems designed for use in electrical locomotives and various types of cars. 3 figs, 3 tables.

409. Arai K, Watanabe H, Furuhata T and Tajima T
TEST OF FIRE FIGHTING FOR LIVE LINE ELECTRIC EQUIPMENT [RAILWAY]
Q Rep Railw Tech Res Inst (Japan), 16(2):92-3, 1975 (Japanese)

Investigates the safety of fire fighting for live line railway vehicles.

410. Namura S, Matsukawa V, Sasaki G, Akaogi I, Saito Y and Hatio K
STUDY ON AUTOMOBILE FIRES
Rep Fire Sci Lab (Japan), (11):39-49, 1974 (Japanese)

It is noted that transportation vehicles suffered considerable damage as a result of fires stemming from earthquakes in Los Angeles and Nicaragua in 1972; e.g. a large number of cargo and light vehicles burned partially or completely. Since the problem of protection against seismic events is an extremely urgent problem in Japan, studies were carried out in 1973-74 on the degree of fire stability of various vehicle configurations. The aim of the research was to work up specific recommendations for modifications of design so as to increase the fire safety. The methods and trends of the tests are described in detail. The individual effects of a fire center on light vehicles of different configuration in close proximity to each other, at varying distances, was studied in the first step. In addition to a visual evaluation of the destructive effect of fire and high temperature, temperatures were measured at different points of the hoods, chassis, glass, seats, motor, etc. of the vehicles. Sets of chromel-copel thermocouples connected to potentiometers by means of fireproof electrical wires were used for this purpose. Temperature versus time for the various points was displayed graphically. In the second stage, analogous studies were made of a considerably larger number of densely parked vehicles, with additional temperature effects on each other. 11 figs, 2 tables.

411. Anon
FIRE-FIGHTING SEMI-SUB
Offshore Serv, 8(6):16, 1975

A ship has been designed to carry out various operations at ocean gas and oil deposits (drilling, laying pipe, repairing underwater assemblies, rescuing personnel, extinguishing fires and fighting oil pollution of the ocean). The ship is 77m long and 52m wide, consisting of two pontoons and six vertical piles, which support a 2-deck, above-water structure. A 6,000 hp electric motor gives a speed of about 12 knots. The lower deck can hold 78 people. The upper deck serves as a helicopter pad. The machine compartment and other fire-hazardous work areas are protected by a halon 1301 fire-extinction system. The ship is equipped with water turntables capable of delivering jets out to 100m to protect ocean scaffolds from collapse in a fire until oil and gas extraction from the well is stopped. Also provided for is a foam delivery system of long duration (several hours). The foam is intended to ensure safety during rescue operations as the oil flows out and burns in the sea. The ship contains a large supply of special chemical concentrate and a system for projecting it into the sea to combat ocean pollution.

412. Anon
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

Fire, toxic, and explosion hazards associated with aircraft accidents and fires are reviewed. Specific areas discussed include prevention techniques; the impact of changes in fuel specifications on aircraft fire safety; and evaluation of test techniques for flame propagation and extinguishment. Actual aircraft accidents are also reviewed and analyzed. The 28 papers are abstracted individually and can be found under the appropriate entry in the source index. The proceedings are availabile from NTIS as AGARD CP-166.

413. Miller RE
SAFETY FUEL RESEARCH IN THE UNITED KINGDOM; Paper No. 1
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

Emphasis is placed on polymeric additives which prevent fuel mist condition. At 0.3 percent concentration these additives prevent kerosene fires under realistic crash conditions with both flame and heated duct ignition sources. High internal phase ratio emulsions gave no fire resistance in these tests. Methods of introducing the additive and the possible extent of water compatibility and filtration problems are discussed. 10 pages, 4 figs, 3 tables, 10 refs. (Author)

414. Weatherford WD Jr and Wright BR
STATUS OF RESEARCH ON ANTIMIST TURBINE ENGINE FUELS IN THE US; Paper No. 2
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The physical, compatibility, and fire safety characteristics of fuel blends containing polymeric antimist agents are discussed in terms of reducing the frequency of in-flight and post-crash aircraft fires. The experimental bench and larger scale evaluation procedures used and the experimental results obtained with several polymeric antimist additives are described. Both fire safety and systems compatibility characteristics and problems are included. Projections are made regarding the future direction of research on such antimist aircraft turbine fuels. 12 pages, 4 figs, 6 tables 22 refs. (Author)

415. Whyte RB and Gardner L
WIDECUT VERSUS KEROSENE FUELS: FIRE SAFETY AND OTHER OPERATIONAL ASPECTS; Paper No. 3
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The relationships between fuel properties and safety and aircraft operation are summarized. The specifications are compared for wide-cut and kerosine type fuels with emphasis on the properties which can affect operation and safety. The difference in volatility and effects on ignition, combustion, and explosion are discussed as well as other properties (fluidity, cleanliness, and vapor release) which can affect aircraft operations. Ground operations (handling, maintenance and engine starting) and flight operations (fire hazard, engine relight, fuel system icing and freezing, range and payload) are considered. It is concluded that, provided all necessary precautions are diligently enforced the risks involved in using wide-range fuel are at worst only marginally greater than with kerosine. 20 pages, 11 figs, 6 tables, 21 refs. (Author)

416. Walsh RH, Timby EA and Robinson DJR
SYSTEMS PROBLEMS ASSOCIATED WITH THE USE OF SAFETY FUELS; Paper No. 4
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The performance of components in aircraft fuel systems is investigated when using crash-fireresistant antimisting aircraft fuels. The effect that the systems have on the fuels is also considered. It is found that the use of safety fuels could result in a continual degradation of their crashfire-resistant properties. The degradation in the major components of the system is measured and the results are used to program a computer study to predict the state of the fuel remaining in the aircraft on landing following a full range flight. 12 pages, 14 figs. (Author)

417. Frechou G
IGNITION PROOFING OF FUEL TANKS; Paper No. 5
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy (French)
Sponsor: AGARD

Several topics are discussed in this paper, principally the causes of fires in connection with fuel flammability and the main precautions taken to reduce the risk and to define the position of the aircraft designer with regard to the advantage of tank ignition proofing in the face of increasingly stringent competition within the air transport industry. 7 pages, 2 figs. (Author)

418. Tugaye J
IGNITION PROOFING OF FUEL TANKS WITH OXYGEN-DEFICIENT AIR OBTAINED BY DIFFUSION THROUGH A SEMI-PERMEABLE MEMBRANE; Paper No. 6
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy (French)
Sponsor: AGARD

The possibility of using oxygen-deficient air in the ignition proofing of fuel tanks was successfully tested in the laboratory. The oxygen-deficient air is obtained by diffusing air under pressure through a special synthetic semi-permeable membrane 0.2 micron thick, supported by a porous plate of the same material 0.2 mm thick. Depending on the temperature, oxygen will diffuse two or three times more rapidly through such a system than nitrogen. High pressure air contained within such a system will therefore become oxygendeficient. A practical airworthy system utilizing this concept inside fuel tanks must include the following systems: heat exchangers, auxiliary air compressor, and fuel deoxygenating device. The proposed system would be primarily advantageous on aircraft undergoing a large number of landings and takeoffs between refuelings, since it would then be lighter and less bulky than a system using liquid nitrogen. 5 pages, 3 figs. (Author)

419. Gardner L and Wong JKS
FLAME PROPAGATION IN AIRCRAFT VENT SYSTEMS DURING REFUELING; Paper No. 7
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

An investigation was made to determine if ignition at the fuel system vent box of a large commercial aircraft during refueling could result in flame propagation through the vent system and cause an explosion inside one of the fuel tanks. The program was initiated as the result of an explosion during a commercial refueling and was confined to investigating the type of series of aircraft involved utilizing a simulation of part of the vent system leading to the tank where the explosion originated. The ability of the flame to propagate was demonstrated using wide-cut fuel and a 50/50 mixture of wide-cut fuel and kerosene. No propagation occurred with kerosene nor with wide-cut fuel that had lost 5 percent of its light ends. Flame propagation and explosion intensity were found to depend on mixture temperature, fuel/air ratio, mixture flow velocity, and oxygen content of the air. 9 pages, 2 figs, 4 tables, 3 refs. (Author)

420. Mahood L
DYNAMIC MODELING OF AIRCRAFT FUEL TANK ENVIRONMENTS AND VULNERABILITY; Paper No. 8
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; Apr 7-11, Rome, Italy
Sponsor: AGARD

The environments, hazards, and vulnerability of regions adjacent to and within aircraft fuel tanks are discussed along with the importance and difficulties of developing fuel tank environment models to assess aircraft combat vulnerability and operating safety. Various approaches to modeling the flammability of the ullage of an aircraft fuel tank are described. Examples are given to illustrate various ways that dynamic effects radically alter equilibrium vapor conditions in the ullage. The method of applying the fuel tank ullage environment model to computerized aircraft vulnerability programs is described. 9 pages, 3 figs, 2 refs. (Author)

421. Blavy A
CABIN FINISHING MATERIALS IN CIVIL PASSENGER AIRCRAFT; Paper No. 9
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy (French)
Sponsor: AGARD

A review of the various types of cabin finishing materials used inside civil passenger aircraft and their properties was presented, with special focus on their flammability and generation of toxic fumes when set afire. The following facts were summarized: (1) materials from which fires may be easily extinguished generally emit more smoke, (2) fire-proof materials often emit toxic fumes, (3) combustion of these materials, due to their self-extinguishing properties, results in oxygen depletion and carbon monoxide formation, the primary cause of intoxication. The primary emphasis should be placed on rapid extinguishing of any incipient fire. 3 pages. (Author)

422. Parker JA, Kourtides DA, Fish RH and Gilwee WJ, JR
FIRE DYNAMICS OF MODERN AIRCRAFT FROM A MATERIALS POINT OF VIEW; Paper No. 10
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

A general approach for selecting polymers to increase fire safety in aircraft is described. It is shown that polymer flammability and thermal protection capability are related to the molecular structure of the polymer and its thermochemical properties. These criteria are used to develop advanced fire resistant materials which can achieve increased survivability in both post-crash and in-flight fires. The degree of fire hardening of materials depends greatly on the available heat load and fire threat present. It is shown that improvements in fire safety can be achieved by the use of polymers possessing certain basic thermochemical parameters such as high char yield. 11 pages, 14 figs, 1 table, 9 refs. (Author)

423. Godfried LM
CRITICAL EVALUATION OF TODAYS FIREPROOF TESTING OF AEROSPACE MATERIALS; Paper No. 11
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The usefulness of the requirements and test methods for assessing materials or materials combinations in aerospace vehicle application is discussed. It is shown that the application, test requirements, and test methods criteria for materials sometimes provide questionable fire safety. 10 pages, 17 figs. (Author)

424. Auvinet J and Favand M
MEASUREMENT AND ANALYSIS OF SMOKE AND TOXIC GASES RESULTING FROM THE COMBUSTION OF AIRCRAFT CABIN FINISHING MATERIALS; Paper No. 12
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy (French)
Sponsor: AGARD

The results of studies and research on the combustion of aircraft cabin finishing materials and the resulting smoke generation and production of toxic gases are reported. Results of tests measuring the concentration of the various gases resulting from the combustion of these materials were first presented, based on burning small samples under controlled conditions. Next, a near full-size mockup of a simulated aircraft cabin section, divided into passenger and freight sections by a horizontal floor, was constructed and instrumented for more realistic combustion tests. This mockup was equipped with ventilation, safety, fire extinguishing, heat protection, pressurization, lighting, and chemical analysis systems. Preliminary tests were undertaken with this mockup and were reported. 12 pages, 7 figs, 5 tables. (Author)

425. MacDonald JA and Wyeth HWG
FIRE PROTECTION OF FUEL SYSTEMS IN COMBAT AIRCRAFT; Paper No. 17
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The conditions which affect fire and explosion probability within aircraft fuel tanks and surrounding bays are examined. Particular attention is given to the effect of fuel type, target construction, and other environmental conditions. From a knowledge of the physical effects following projectile attack, systems are suggested which could significantly reduce the risk of fire and explosion. 15 pages, 11 figs, 1 table 1 ref. (Author)

426. Botteri BP
AIRCRAFT FIRE PROTECTION TECHNOLOGY; Paper No. 18
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

Aircraft fire protection under natural and hostile (combat) flight environment conditions is discussed. Achievement of fire protection capability is dependent upon a knowledge of ignition, flammability, and reaction severity characteristics of the combustible materials present and use of this knowledge in the design of the aircraft. Specific areas discussed include fire and explosion design measures, advanced fire and overheat detection systems, void space and dry bay fire suppression techniques, and fuel tank fire and explosion protection systems. 15 pages, 4 figs, 3 tables, 21 refs. (Author)

427. Vincent J
FIRE PROTECTION OF MILITARY AIRCRAFT; Paper No. 19
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The problems associated with 'classical' engine bay fire detection and suppression systems are examined along with airframe design constraints. The primary and secondary fire problem is considered. Statistical evidence from modern war shows that the highest proportion of aircraft kills is due to primary and secondary fire. The application of possible fire suppressant methods is discussed. The current structural and system design philosophy is questioned with respect to achieving improved fire protection of military aircraft. 15 pages, 7 figs. (Author)

428. Sarkos CP
CHARACTERISTICS OF HALON 1301 DISPENSING SYSTEM FOR AIRCRAFT CABIN FIRE PROTECTION; Paper No. 23
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

A cabin fire protection system using Halon 1301, an extinguishing agent previously tested and shown to be effective in suppressing and controlling fires in a simulated transport cabin section and a cargo compartment, is investigated. Tests were conducted in an obsolete but completely furnished DC 7 passenger cabin equipped with two candidate Halon 1301 dispensing systems: modular nozzle and perforated tube. Under no-fire conditions, continuous measurements were made of the Halon 1301 concentration at approximately 20 locations; measurements were also made of temperature, noise, pressure, and visibility. The modular nozzle system was judged to be best by virtue of its producing more rapid and effective agent distribution, resulting in greater potential fire protection capability. Halon 1301 was found to rapidly permeate all cabin airspaces, including those shielded from the discharge streamlines. 16 pages, 12 figs, 22 refs. (Author)

429. Beery GT, Clodfelter RG, Gandee GW, Spear DM and Wight DC
ASSESSMENT OF JP-8 AS A REPLACEMENT FUEL FOR THE AIR FORCE STANDARD JET FUEL JP-4. PART 1. ASSESSMENT OF JP-8/JP-4 FUEL IN NONCOMBAT ENVIRONMENT. FINAL REPORT, JUN 1972-APR 1975. Wright-Patterson AFB, OH, Air Force Aero Propulsion Lab; AFAPL TR-74-71-Pt-1, 91 pages, Jun 1975
Availability: NTIS AD-A016 763

This report is an assessment of JP-8 as a replacement fuel for the Air Force standard jet fuel JP-4. All facets of the problem are examied including fire safety, storage, handling and maintenance safety, laboratory testing, gunfire testing, flight testing, cost and availability, and impact on current Air Force weapons systems. The report concludes that a significant improvement in overall fire safety could be achieved by conversion to JP-8. However, additional investigation into problems related to low temperature ground start and altitude relight should be accomplished prior to conversion.

430. Lugar JR and Rollhauser CM
FIRE-PROTECTION STUDY OF HIGH-PERFORMANCE SHIPS. David W. Taylor Nav Ship Res and Dev Center, Annapolis, MD, MAT-75-46, 86 pages, Feb 1976
Availability: NTIS AD-A021 939/4GA

A study was conducted on the problems associated with fires aboard high-performance ships. Basic ship layouts and descriptions were reviewed along with the present firefighting systems. Potential fire problems relating to construction materials, high fuel and payload capacities, gas turbines, and new habitability materials are discussed. Based on the study, it was determined that the state-of-the-art in fire detection and passive fire protection does not offer complete solutions to the fire threat. Present firefighting systems are considered inadequate to combat large fires or fires caused by hostile attack. No backup systems are provided if the existing Halon 1301 system fails to extinguish fires in the machinery spaces. Water is not readily available to combat class A fires throughout the ships. (Author)

431. Anon
REPORT OF THE ARMY SCIENTIFIC ADVISORY PANEL AD HOC GROUP ON FIRE-SAFE FUELS. Deputy Chief of Staff for Res, Dev and Acquisition (US Army), 15 pages, Mar 1976

The vulnerability of combat vehicles to catastrophic fuel fires is of continuing major concern to the US Army. An Army Scientific Advisory Panel Ad Hoc Group was organized to review the present Army Fire-Safe Fuel program and provide guidance for future research and development efforts in this area. The group advises that long-term basic research, environmental impact and chronic toxicity programs be undertaken. Additionally, physical fuels management efforts, corrosion/material influence and involvement of DARPA should be pursued. Extensive bibliography is included. (Author)

432. Braun E
A FIRE HAZARD EVALUATION OF THE INTERIOR OF WMATA MOTORAIL CARS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-971, 35 pages, Dec 1975
Availability: NTIS PB-249 776/6GA

A series of fire tests was conducted for the Washington Metropolitan Area Transit Authority to assist them in assessing the potential for fire hazard in the new Metrorail subway cars. Results of small-scale laboratory tests were found inadequate for this assessment. Results of full-scale tests on the mock-ups of the interior (and on a real car for a smoke penetration test) show that the potential for hazard arises primarily from the seat padding and covering and from the plastic wall lining. The hazard arises both from smoke development and from spread of flame and heat. The times to reach unacceptable conditions have been determined for several test conditions. It is recommended that the authorities review these times in the context of what they consider to be appropriate times for safe escape. Recommendations are made for increasing the amount of time available for escape. These would require changes in the seating and wall lining materials. (Author)

433. Supkis DE
REFURBISHMENT OF NASA AIRCRAFT WITH FIRE RETARDANT MATERIALS. Nat Aeronautics and Space Admin, L.B. Johnson Space Center, Houston, Tex; NASA TM-X-58165, JSC-09832, 29 pages, Oct 1975
Availability: NTIS

Selected fire-retardant materials for

possible application to commercial aircraft are described. The results of flammability screening tests and information on the physical and chemical properties of both original and newly installed materials after extended use are presented in tabular form, with emphasis on wear properties, strength, puncture and tear resistance, and cleanability. (Author)

434. Schafran E
TRANSIT FLAMMABILITY REQUIREMENTS. Transit Development Co, Inc; TDC/500-74/3, 11 pages, Jun 1974
Availability: NTIS PB-241 851/5ST

Control of the flammability characteristics of furnishings within a structure will reduce the fire hazard to the structure and enhance the life safety of its occupants. Flammability of materials should be considered along with comfort, cost and wear. Quantifying flammability, setting acceptable standards, identifying appropriate test procedures, and locating the material to satisfy the standards are steps taken by the Port Authority of New York and New Jersey. (Author)

435. Anon
FIRE SAFETY AND FIRE HAZARDS RELATED TO MATERIALS IN CARS OF WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY. Nat Acad Sci, Nat Res Council, 25 pages, 11 refs, 1975
Availability: NTIS PB-244 971/8ST

This report by the National Materials Advisory Board of the National Research Council represents a review of the technical decisions made by WMATA in selection of materials and design for car interiors from the viewpoint of fire safety. It is concluded that electrical fires are a continuing threat to rapid transit system safety and that awareness of fire safety in transport vehicles was only emerging when the WMATA cars were planned. Review of prior fire experiences was not made; emphasis on comfort and styling have increased fire load in car interiors; hydraulic brake systems increase the probability of electrical fires; choice of polymeric interior materials and wool carpeting should be reevaluated. (Author)

436. Graves KW
DEVELOPMENT OF A COMPUTER PROGRAM FOR MODELING THE HEAT EFFECTS ON A RAILROAD TANK CAR. Calspan Corp; FRA ORD-75-33
101 pages, Jan 1973
Availability: NTIS PB-241 365/6ST

A mathematical model has been programmed in FORTRAN IV that represents the response to a fire environment of a railroad tank car laden with a volatile, flammable fluid. Inputs to the program include total mass of lading per foot of tank length, tank length, number and flow area of relief valves, their opening and closing pressure, thickness and thermal conductivity of exterior insulation, and array of the thermodynamic properties of the lading, its initial condition, and heat transfer coefficient and fire temperature at various points on the tank. Output includes tank pressure, temperatures of the liquid and vapor, temperatures of the interior surface of the shell, mass of liquid remaining, and location of the liquid level. These are printed for the end of every computing interval, thus indicating the history of each.

Study sponsored by the US Dept of Transportation, Federal Railroad Admin, Washington, DC.

437. Students Against Fire, Calvin Y, Chan WK, Chi LL (Ed) and Pagni PJ (Advisor)
DESIGN OF A FIREPROOF VEHICLE. Univ of California (Berkeley), Fire Res Group; UCB FRG 75-18, 76 pages, 27 figs, 10 refs, Jul 1975
Availability: NTIS

A Chevrolet Vega notchback was modified to insure maximum fire safety for passengers. Various fire safety devices were added to the car. The gas tank was moved from its usual position into the trunk to avoid direct hitting due to rear-end collision. The shape and location of the gas tank were designed to allow finite volume change and avoid spilling of gasoline. The fuel line and the filler tube were designed to withstand higher pressure. A honeycombed-multi-beer-can-energy-absorption-system was installed in the rear bumper to absorb most of the impact energy due to a moderate speed collision. Meanwhile, to insure positive fire safety to passengers, an integrated circuit control system which could detect fire and activate a combined Halon and dry chemical extinguishant system was added. Experiments were performed on individual parts and the results were very satisfactory. Due to financial limitations, an actual dynamic test of the whole system was not performed. Some of the important structural modifications have not been done on the present vehicle because of the complications such alterations would involve. (Author's Abstract)

438. Connell WM
SAFETY PRIORITIES IN RAIL RAPID TRANSIT. VOL I. REPORT. Transit Development Corp, Inc; UMTA DC-06-0091-75-1, 45 pages, Mar 1975
Availability: NTIS PB-242 953

Rail Rapid transit presently produces the lowest number of fatalities of any of the major passenger transportation modes. This report develops a program to identify what should be done to aid in assuring that rail rapid transit safety continues. All aspects of rail rapid transit safety are reviewed, hazards are identified, priorities established, and remedial actions recommended. Recommendations include: 1) an evaluation program for materials which utilizes new methods of computing and assessing risk in the areas of flammability, smoke and toxicity; 2) compilation and dissemination of procedures, techniques, and equipment used in the safe evacuation of rail rapid transit patrons; 3) an improvement study of fixed stairs in rail rapid transit facilities to determine whether significant reduction can be achieved in the number of patron falls; 4) a safety education plan to produce films for public education and use in primary schools; 5) work efforts in the development of fire detection and transit vehicle fire extinguishing equipment; 6) establishment of criteria for transparencies used for transit vehicles; 7) determination of hazards of power regeneration and the evolution of procedures to eliminate them; and 8) continuation and support of the Safety Advisory Board techniques for analyzing and assessing safety in rail rapid transit to help assure coordinated technical information input to transit safety development. A bibliography is furnished.

Sponsorship was by the Urban Mass Transportation Admin, DOT. See also Safety Priorities in Rail Rapid Transit, Vol 2, Exhibits.

7. FIRE SERVICE ORGANIZATION AND FACILITIES

a. ADMINISTRATION AND MANAGEMENT

439. Minaev SN
DETERMINING CREW COMPOSITION FOR PUMPER-LADDERS
_Vopr_ekon__pozhar_okhrane_, (3):3-14, 1974 (Russian)

An analysis of statistical data from 30,000 firemen shows that the optimum number of crew members on pumper-ladders is six. (Author)

440. Foster JF
OPERATIONAL FIREMEN AND FIRE PREVENTION
_Fire_Eng_J_, 36(102):31-34, 1976

The object of the survey was to examine the feasibility of using operational firemen to perform fire prevention duties. The survey methods are described, conclusions are summarized, solutions and alternatives are advanced. The results indicate a strong case for the use of operational firemen in the field of fire prevention, but there is a need for a drastic review of attitudes towards fire prevention work both from the managerial level of brigades and from the firemen proper.

441. Siegel J and Weitzmann DO
INFORMATION PROCESSING IN AN URBAN FIRE DEPARTMENT COMMUNICATION SYSTEM
_Appl_Ergon_, 6(3):132-8, 1975

One of the most important functions of any fire department is to provide selective contact with fire fighting units and to dispatch these units based on information gathered from street alarm boxes and telephones. This paper is concerned with the problem of dispatching tactical response information to remote fire fighting units and with the effect of workload on the dispatch function. (Author's Abstract)

7. FIRE SERVICE ORGANIZATION AND FACILITIES

a. Administration and Management

442. Fyffe DE and Rardin RL
AN EVALUATION OF POLICY-RELATED RESEARCH IN FIRE PROTECTION SERVICE MANAGEMENT. Georgia Inst of Technol, School of Industrial and Systems Eng; NSF RA/S-74-019, 554 pages, Oct 1974
Availability: NTIS PB-240 655/1GA

The report presents the results of evaluations of research in the field of urban fire service management. In conducting the study, some 500 references related to fire service management were located and copies of approximately 350, including 65 which were classed as policy-related fire service management research, were obtained. The research reports were subjcted to an evaluation by technical experts and comment by a panel of fire service professionals. Chapters of the report deal with broad, policy-related subject areas with subsections devoted to specific issues within the area. The subsection discussions represent a synthesis of the results of a careful evaluation of policy-related fire management research with information from related nonresearch papers.

443. Walker WE
PERFORMING POLICY ANALYSIS FOR MUNICIPAL AGENCIES: LESSONS FROM THE NEW YORK CITY-RAND INSTITUTE'S FIRE PROJECT. New York City Rand Inst; P-5426, 26 pages, May 1975
Availability: NTIS AD-A022 169/7GA

The New York City-Rand Institute was involved in performing policy analysis for the New York City Fire Department over a period of 7-1/2 years. During this time many changes were made in the Fire Department's operations based largely on the results of the Institute's analysis. This paper discusses some of the changes, proposes some explanations for the success of the project, and describes how the work led to a similar effort to perform deployment policy studies for emergency service agencies throughout the country under federal sponsorship. The paper concludes with some impression about what the work has taught us about performing urban policy analysis for operating agencies and transferring technology to municipal government personnel. (Author)

444. Rider KL and Jacobs BI
AN ANALYSIS OF NEW YORK CITY FIRE DEPARTMENT EXPENDITURES FROM 1968 to 1974. New York City Rand Inst; P-5416, 48 pages, Mar 1975
Availability: NTIS AD-A022 214/1GA

This paper analyzes expenditures of the New York City Fire Department, determining cost allocations for fiscal years 1968-1969 to 1973-1974. The work is part of the research on fire protection resource allocation conducted by The New York City-Rand Institute for the department. Expenditure data derived in this paper will be used in later reports to calibrate several resource allocation models. (Author)

445. Walker WE
APPLYING SYSTEMS ANALYSIS TO THE FIRE SERVICE. New York City Rand Inst; P-5456, 45 pages, Jun 1975
Availability: NTIS AD-A022 271/1GA

Fire department managers, confronted with new and greater demands for fire service and fire protection, need new tools to help them make the most effective use of their firefighting resources. Increasingly they are turning to the techniques of systems analysis. Systems analysis provides an organized step-by-step approach to studying large systems, such as the system of municipal fire department operations, that contain many interacting elements and in which it is very difficult to determine the consequences of a change in policy. (Author)

b EDUCATION AND TRAINING

446. Jacobs DT
PHYSICAL FITNESS AND THE FIRE SERVICE
Nat Fire Prot Assoc; 88 pages, 1976

An exclusive new guide to health through physical fitness, stressing the urgent need for fitness training in the fire service. Practical guidance is given on how to organize a fire department training program. Seventeen floor and apparatus exercises, source references and fitness tests are featured. (Author)

447. Anon
SEATTLE'S SHIPBOARD FIREFIGHTING TRAINING IS COMPREHENSIVE
Fire Chief, 20(3):42-44, 1976

With the help of federal and state funds, and the cooperation of city agencies, Coast Guard, Navy, and industry, some 55 Seattle firefighters have completed over 200 hours of comprehensive marine firefighting training. The curriculum includes ship classification and construction, ship familiarization, manifest reading, policy and report writing, ship boarding and abandoning techniques, vessel hazards, marine fire protection systems, ship stability, special equipment, ship fire tactics, hull and pipe damage control, operation team drills, and helicopter operations. Maximum performance standards have been ensured by strict grading methods. 3 photos.

448. Roberts J
PREPARATION FOR EFFECTIVE INSTRUCTION
_Fire_Eng_, 129(3):40-41, 1976

The author reviews some of the steps of the art of teaching that can be effective if applied to individual instructing methods; these steps are 1) course objectives, 2) resources, 3) educational level of the students, and 4) instructor qualification. 1 fig.

449. Sylvia R
'ARMY OF INSTRUCTORS' NEEDED, LUCHT TELLS ISFSI CONFERENCE
_Fire_Eng_, 129(1):26-32, 1976

The importance of training in developing the performance of any organization as the foundation for a good fire suppression force, a good fire prevention force or any other aspects of the fire service was the theme of the fall conference of the International Society of Fire Service Instructors held Oct 24-27, 1975, in Newton, Mass. Among the various topics on the agenda, the expanding opportunities and responsibilities awaiting instructors as the federal government extends its involvement in the fire service were outlined by the deputy administrator of NFPCA, David Lucht. The problems of state, municipal, and college fire service instructors were discussed in workshops.

450. Sylvia R
MUST FILL THE NEEDS OF FIRE FIGHTERS, ACADEMY SUPERINTENDENT DECLARES
_Fire_Eng_, 129(4):27-28, 1976

The first superintendent of the National Academy for Fire Prevention and Control, David M. McCormack, outlines the academy goals. An insert summarizes these goals: to provide a high-quality facility with up-to-date techniques; to provide courses not available in existing educational agencies; to assist state and local training programs and colleges; to help maintain uniformity and quality of instruction; to reduce fire deaths and injuries; to encourage state and local training programs; to reduce the incidence of arson; and to improve fire safety in buildings.

451. Lamb RTB
CORRESPONDENCE COURSES IN A LARGE FIRE BRIGADE
Fire, 68(848):453-456, 1976

London Fire Brigade, in close cooperation with Southwark College, has developed a system of correspondence courses, of which six are in operation at present. There are, for example, some 450 students in the leading firemen's general education correspondence course alone. The organization of studies, the tutors, tutorial duties, and the psycholcgy of tutoring, results of the effort and difficulties of studying while an operational fireman, are discussed. A course syllabus for the sub-officer's course and the course leading to the examination for Membership of the Institution of Fire Engineers are given in table form. The information provided by the investigation is to be used to improve the guality of future courses. 3 figs.

452. Pendergast R
TRAINING-KEY TO SUCCESSFUL RESCUE AND RECOVERY TEAM
_Fire_Chief_, 20(4):66-69, 1976

The objectives and training requirements for scuba rescue and recovery teams of both paid and volunteer fire departments are identified. Team equipment and individual equipment and cost are compiled in a table. 9 photos, 1 table.

453. Markuzon IA and Brushlinskiy NN
MODELING THE PROCESS OF TRAINING ENGINEERING PERSONNEL FOR FIRE PROTECTION
_Vopr_ekon_pozhar_okhrane_, (3):38-43, 1974 (Russian)

A mathematical model of the training cf

specialists with advanced education for fire protection is examined. (Author)

454. Anderson W
SMOKE DIVER TRAINING PROGRAM DEVELOPED BY VOLUNTEER DEPARTMENT
Fire_Eng, 129(5):24-25, 1976

A cadre of six men of the Greensburg Fire Dept (Pa) applies the knowledge learned at a five-day smoke diver's training school at the Florida State Fire College to the establishment of an adequate self-contained breathing apparatus training program. 4 figs.

455. Isman WE
IN-SERVICE TRAINING PROGRAM
Fire_Eng, 128(11):29-31, 1975

To ensure that a continuing level of expertise is maintained by personnel in the field, an in-service training program which covers manipulative skills, departmental operational practices, pre-fire planning and critiques of fireground operations was developed. 3 refs.

456. Chaiken JM, Ignall EJ and Walker WE
A TRAINING COURSE IN DEPLOYMENT OF EMERGENCY SERVICES: INSTRUCTOR'S MANUAL. New York City Rand Inst; R-1784-1-HUD, 173 pages, 72 refs, Sep 1975

This course outline provides lesson plans and visual aids for these lectures so that they can be presented by anyone who already understands the subject. References to the appropriate source materials are also provided. Potential audiences for the course include fire service administrators and planning officers, police patrol administrators and planning officers, ambulance agency personnel, city officials, operations research analysts, and mixtures of these groups.

This instructor's manual may also be useful to individuals who wish to undertake a self-directed study of deployment analysis for emergency services. The literature in this field is quite extensive and includes methodological reports, descriptions of computer programs, and case studies of applications of deployment analysis in particular cities. Therefore, it may be difficult for the student to determine which papers are related to the subject he wishes to learn and which ones should be read ahead of others. By following this course outline, it is possible to determine a suitable sequence in which to study the various documents and to gain a general notion of the contents of each of them in advance. (Author's Abstract)

457. Anon
A GUIDE FOR PLANNING AND SELECTING THE SITE FOR THE NATIONAL ACADEMY FOR FIRE PREVENTION AND CONTROL. Acad for Educational Development, Inc, NY; NFPCA CR-76/01, 190 pages, Nov 1975
Availability: NTIS PB-248 092/9GA

The purpose of this report is to develop a guide for planning and selecting the site for the National Acad for Fire Prevention and Control. The investigation determined that the legislation, the Acad's mission, the nature of the training to be offered by the Acad, and the instructional techniques to be used indicate the need for a national campus. The Acad may obtain its physical facilities by building a new structure or by adapting an existing Federal, state, or privately-owned facility to the Acad's purposes. Cost constraints favor the latter approach. Site selection criteria are developed and four categories of criteria are arranged in a matrix for possible use by the Site Selection Board.

458. Wright EE, Miller GE and Dietz R
A FIRE TRAINING SIMULATOR. Urban Observatory of San Diego, CA; NSF RA-760038, 28 pages, Feb 1976
Availability: NTIS PB-252 306/6GA

This report describes the design, construction, operation, training procedures and practical application of the fire training simulator. The fire simulator is a light projection system using a two-stage overhead projector in combination with a 35mm slide projector, which produces the illusion of fire and smoke. The operator has complete control to extend the fire, involve different exposures or create explosions. As the fire company responds to the simulated fire situation and makes the proper decision for fire fighting, the operator can give the appearance that the fire is going out. (Author)

459. Chaiken JM, Ignall EJ and Walker WE
A TRAINING COURSE IN DEPLOYMENT OF EMERGENCY SERVICES: STUDENT'S MANUAL. New York City Rand Inst; R-1784-2-HUD, 179 pages, Sep 1975
Availability: NTIS PB-250 463/7GA

This student's manual provides lecture notes and visual aids for a course in the deployment of emergency services. It is not self-contained, but is designed for use in accordance with the directions of an instructor who is using the instructor's manual (R-1784/1-HUD). Space is provided on each page for any notes and references the student may wish to record. (Author)

c. GENERAL EQUIPMENT

460. Minaev NA, Isaev MN, Ivanov AF, Konopkin NF, Makarov VI, Solomonik YuA and Shcherbakov MF
FIRE-FIGHTING EQUIPMENT (Pozharno-Tekhnicheskoe Vooruzhenie)
Stroyizdat, Moscow; 372 pages, 1974 (Russian)

Essential information on firefighting tools, appliances, equipment, vehicles and apparatus as well as on the materials used in manufacturing them and on maintenance and repair are given in the book. Particular attention is devoted to the structure and application of fire pumps and to the gas- and smoke-protection equipment of firefighting units. The book is intended as a textbook for students of the fire-engineering schools and can also be used by experts engaged in fire protection. (Author)

461. Kuznetsov VV
DETERMINING CERTAIN QUALITY INDEXES FOR FIRE EQUIPMENT COMPONENTS
Vopr ekon pozhar okhrane, (3):137-154, 1974 (Russian)

Methods are discussed for determining the quality level for production-line parts. Examples are given for determining individual indexes. (Author)

462. Barabanov LP
SOME METHODOLOGICAL ASPECTS OF ENGINEERING PREDICTION
Vopr ekon pozhar okhrane, (3):111-117, 1974 (Russian)

A mathematical analysis of materials proposed for use in predicting developmental tendencies of individual kinds of fire equipment is presented. (Author)

463. Utkina Zh D, Podkol'zin GP and Bodashevskiy IS
ECONOMIC EFFECTIVENESS OF INTRODUCING AERIAL PLATFORMS IN FIRE PROTECTION
Vopr ekon pozhar okhrane, (3):44-50 1974 (Russian)

A calculation is made of the economic effectiveness of introducing articulated elevating platforms in fire protection. (Author)

464. Solomon SS
WARNINGS ABOUT EMERGENCY LIGHTS
Fire Eng, 129(5):20-23, 1976

The originator of the high-visibility lime yellow concept for apparatus and the developer of the internationally accepted retroreflective tape patterns for bunker coats, bunker pants and boots attacks the problem of emergency lights. The author presents four aspects for consideration: lack of scientific information; light intensity or brightness; which lights are emergency warning lights; and the emergency light location and pattern. A box contains a display of sample emergency light configurations. 1 fig.

465. Janson SW
RUSTED AIR CYLINDERS SCOURED ON SHOP-MADE TUMBLER
Fire Eng, 129(6):27, 1976

Rust in air cylinders brought on by Florida's weather was scoured out by a tumbler designed and built to clean them. The tumbler consists of a frame, powered center shaft, two outboard rollers, and a flex-coupling driven by a 1/10-hp, 60-rpm electric motor. As many as six 45 ft cylinders or one 300-cubic foot cylinder can be tumbled at one time. 5 figs.

466. Amato G
CALCULATING PUMP PERFORMANCE
Fire Internat, 5(51):93-99, 1976 (English, French, German; Spanish abstract)

The performance of pumps driven by internal combustion engines is affected by the ambient atmospheric conditions, both directly and through their effect on the power delivered by the engine. Consequently, when the performance of a motor pump is quoted, the conditions of temperature, pressure and, in some cases, the relative humidity of the air where the measurements were made, should be stated or implied. Performance readings obtained under actual conditions are converted into those that would be obtained under standard conditions by calculation. 5 figs.

467. Holmes WO
PORTABLE HOISTING AND EVACUATION APPARATUS
US Patent No. 3,860,092, Cl 187-6, (A62b 1/02), Appl 19 Apr 73, Discl 14 Jan 75

The patent is issued for a portable hoisting system to be erected along the outside of a building from a stanchion of any kind on the top of the building. The apparatus consists of a portable hoisting system including an anchoring system with anchor line, pulleys, load lines, reeving and winch means, and a method of rigging the system. (Author)

468. Dietz R
SURVEY OF FIRE HOSE SPECIFICATIONS. Urban Observatory of San Diego, CA; NSF RA-760037, 18 pages, 1976
Availability: NTIS PB-252 299/3GA

The San Diego Technology Action Center (SANDTAC) has as its primary objective the creation and testing of a management process for the transfer and systematic utilization of existing technology to both short-term and long-term urban problems in the San Diego region. Recently, the SANDTAC team was asked to investigate the current specifications used by other cities in purchasing fire hose in order for the city departments to determine if San Diego's specifications were becoming too difficult to meet by most suppliers. This report is the result of the survey of fourteen cities conducted by SANDTAC. The wide variation in specifications used in purchasing fire hose by these cities is considered significant. (Author)

469. Showalter TW and Eckel JS
COMPARISON OF TWO FIRE TRUCK TURRET CONTROL SYSTEMS. Wright-Patterson AFB, OH, DoD Aircraft Ground Fires Suppression and Rescue Office; DoD AGFSRS-76-1, 32 pages, Jan 1976
Availability: NTIS AD-A022 482/4GA

Eight Air Force fire fighting instructors performed a variety of tasks using a standard turret control system (a manually operated, hydraulically assisted system) and a newly designed electrohydraulic hand held remote turret control system. The non-fire tests, demanding speed and accuracy, were negotiated significantly better with the new remote system. However, neither system outperformed the other in the fire tests. Perceptual problems caused by the fire and smoke limited operator performance, especially when using the new remote system. (Author)

470. Thomas MW
GROUND TRANSPORTATION FOR POLAR OPERATIONS - 16 WHEEL LOW-GROUND-PRESSURE VEHICLE (LGP-16). Civil Eng Lab (Navy), Port Hueneme, CA; CEL TN-1422, 33 pages, Jan 1976
Availability: NTIS AD-A021 845/3GA

Transportation operations at remote sites in polar regions require specialized equipment due to the climatic and terrain conditions. Design criteria were developed for a multipurpose, 5-ton-capacity, high-flotation-tired, prototype vehicle to move personnel and cargo and to provide fire-fighting crash-rescue capabilities to aircraft operations. Contracts were awarded for the design and fabrication of a 16-wheel low-ground-pressure vehicle (LGPV-16). After delivery of the vehicle in late 1970, initial testing indicated the need for a tire with better flotation and traction capabilities. After new tires had been installed and minor modifications made to the suspension system, the vehicle was retested before shipment to Antarctica. (Author)

471. Saunders P, Jackson RHF, Meyers PR and Pearl MH
ISSUES IN FIRE VEHICLE REPLACEMENT: USERS' VIEWS AND SYNTHESIS. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-694, Apr 1975

This report documents the findings and recommendations from a study of fire vehicle replacement procedures. Exploration of that subject proved to require, as well, consideration of issues arising in: 1) writing apparatus specifications, 2) maintaining and repairing vehicles, and 3) obtaining spare parts. The topics and most of the recommendations described herein are derived directly from visits and telephone interviews with fire department officials across the country. The recommendations of the study call for greatly increased communications among departments, the development of standards for vehicle performance, maintenance staff size, etc, and national and regional centers for training personnel and establishing standard vehicle testing procedures. (Author's Abstract)

d. INFORMATION SYSTEMS

472. Semikov VL
AUTOMATED INFORMATION SYSTEMS IN FIRE PROTECTION
Vopr ekon pozhar okhrane, (3):129-136, 1974 (Russian)

The aim of automated fire-protection information systems in the Fire Protection Administrations and Departments is to provide for operational collection, preparation, processing and output of reliable information in a volume adequate for optimal decision making. (Author)

473. Thrasher CL
EXPAND DATA SYSTEM TO PROVIDE MORE INFORMATION
Fire Chief, 20(2):33-35, 1976

Using a simple data coding technique, the FIRES-2 information report system, it is possible to manage change in a medium-size suburban fire department. The orignal system (FIRES) included a general department activity report, statistical report, alarm versus day of alarm matrix, expected alarm matrix and a vehicle run report. The FIRES-2 system expanded the reports for department activity, medical emergency activities and added personnel and training records. 1 fig, 2 tables.

474. Strout RE
USE OF THE LLL FIRE DATA BASE. Univ of California (Berkeley), Lawrence Livermore Lab; UCID 16916, 23 pages, Oct 1975
Availability: NTIS UCID 16916

475. Anon
PUBLIC SAFETY SUBSYSTEM. COMPUTER AIDED FIRE DISPATCH. FUNCTIONAL SPECIFICATIONS. USAC Project, Long Beach, CA; USAC LBC2b, 0620-FS-01, 230 pages, Sep 1973
Availability: NTIS PB-249 177/7GA

The report is from a USAC series produced by the city of Long Beach, covering activities from systems analysis through implementation and evaluation of urban information systems. This document represents the final design specification for the Computer Aided Fire Dispatch Component. This component enables fire dispatchers to access data bases and on-line tables, in order to dispatch the needed emergency equipment to an incident rapidly and accurately. (Author)

e. INVESTIGATION AND REPORTING

476. Swartz J
HOW MANY "SAVES"?
Fire Command, 43(5):28-31, 1976

The research division of NFPA has set out to establish a reasonable definition of a "save", that is, the number of people rescued by a fire department, and the rules for counting them. A form was constructed (included in a box in the article with discussion) and evaluated by five fire departments by actual use on a trial basis. The fire service reviewers and the majority of test personnel concluded that the form was a usable instrument that would provide potentially useful information, though not worth the effort for all fire departments.

477. Anon
PUBLIC SAFETY SUBSYSTEM. FIRE DATA COLLECTION AND ANALYSIS SYSTEM. FUNCTIONAL SPECIFICATIONS. USAC Project, Long Beach, CA; USAC LBC2a, FDC PDC-001, 179 pages, Jan 1973
Availability: NTIS PB-249 178/5GA

The report is from a USAC series produced by the city of Long Beach, covering activities from systems analysis through implementation and evaluation of urban information systems. This document represents the final design specifications for the Fire Data Collection and Analysis System. The system encompasses three major informational activities of the Fire Department: inspections, incidents, and investigations. The purpose of this automated system is to record and provide access to this information. (Author)

f. PERSONAL EQUIPMENT

478. Faria LE
PROTECTIVE BREATHING APPARATUS
Robert J Brady Co, Bowie, MD; 77 pages, 1975

This is an instruction book for firefighters in the use of self-contained breathing apparatus. Author Faria is Fire Instructor Deputy Chief at the Massachusetts Firefighting Academy. The book is divided into six main chapter headings which should give an idea of the scope of the book: Introduction, the facepiece, oxygen apparatus, demand-type breathing apparatus, hose masks, and firefighting operations. Most pages of the book are devoted to the demand-type apparatus and firefighting operations. For example, under the firefighting chapter these main topics are covered: Fire conditions, buddy breathing, breathing directly from the regulator, pre-fire plan, procedures, search and rescue, and conclusions. The artwork and drawings are excellent and contribute much to the effectiveness of the book.

479. Takahashi S
DEVELOPMENT OF AN OXYGEN-GENERATING BREATHING APPARATUS. PART 1. THE REACTIVE CHARACTERISTICS OF POTASSIUM SUPEROXIDE, MAINLY WITH EXHALED BREATH
Rep_Fire_Res_Inst_Japan, (41):33-48, 1976 (Japanese) (English abstract)

Prior to the development of a new mask, some experiments were performed to determine the reactive characteristics of porous KO(2), tablet KO(2) and granular KO(2) by passing water-free CO(2)-air, CO(2) free water-air and exhaled breath over the three forms of KO(2). Granular KO(2) proved to generate oxygen best, and therefore it became the subject of further tests to determine the volume of oxygen liberated, for which an equation is derived. From this equation the oxygen concentration in the mask and the volume of deficient oxygen are calculated to be able to design a supplementary oxygen device. 7 figs, 5 tables, 4 refs. (Author)

480. Takahashi S
DEVELOPMENT OF AN OXYGEN-GENERATING BREATHING APPARATUS. PART 2. DESIGN AND PERFORMANCE
Rep_Fire_Res_Inst_Japan, (41):49-61, 1976 (Japanese) (English abstract)

The desirable properties of the apparatus were determined by analyzing a large number of fire incidents and by considering the abilities and objectives of the fire service. The operating time of the apparatus was of primary importance. The standard operating time is 20 min at a breathing rate of 40 l/min or an oxygen intake rate of 1.7 l/min. A supplementary oxygen supply was required. A small oxygen cylinder (20 ml capacity) was used. The newly developed apparatus is of the return type, in contrast to the conventional circuit type, because it recycles the regenerated gas through the oxygen canister. The main problem is the formation of moisture in the mask owing to reheating of the cooled regenerated gas. A cooler atmosphere would eliminate this defect. If necessary, the circuit type can be used. The new mask enables a man to reach the 25th story of a building and return at a fast pace. 9 figs, 3 tables, 6 refs. (Author)

481. Molter JD
ADVANCES IN PROTECTIVE CLOTHING
Fire_Eng, 128(11):23-5, 1975

Advances in the design of different types of garments that are available specifically for various hazard levels are outlined. The chart presents findings for a number of typical systems in use. These data indicate each turnout coat system's ability to isolate and insulate the wearer from a high thermal hazard. The importance of the combination of material, weight and thickness is demonstrated in the table.

482. Bartsch G
PROTECTIVE BREATHING MASK
GDR_Patent__No.__110,763, Cl 61a 29/30, (A62b 23/02), Appl 3 Jan 74, Discl 12 Jan 75

A respirator is patented for protection against aerosol (dust). The filter chamber seals gaps between the filter and the chamber housing, preventing the penetration of unpurified air under the mask of the respirator. The design of the respirator differs from those in existence in that the upper part of the filter chamber is in the form of a truncated cone; thus, the edges of the flat filter press tightly against the chamber housing. 1 fig. (Author)

483. Young ME
PROTECTIVE CLOTHING. PART 2. FIRE AND RADIATION ENVIRONMENTS (A BIBLIOGRAPHY WITH ABSTRACTS). Nat Tech Information Service; NTIS PS-76/0268/3GA, 73 pages, Apr 1976
Availability: NTIS NTIS PS-76/0268/3GA

Research on clothing and equipment for maximum protection while fighting fires and in radiation conditions is described in the reports abstracted. Treatment of fibers and textiles, design of clothing, testing for physiological tolerances, methods of decontamination after exposure, and equipment acceptability are topics included. (Contains 68 abstracts.) (Author)

484. Giordano TA
DEVELOPMENT OF A SPEECH AMPLIFIER SYSTEM FOR USE WITH THE NAVY A4 OXYGEN BREATHING APPARATUS AND A PROPOSED FIREFIGHTING INSTRUCTOR'S BREATHING DEVICE. FINAL REPORT. Epsco Labs, Stamford, CT; Rept 5081-1, 88 pages, Jul 1975
Availability: NTIS AD-A014 653

The purpose of the program was to design, develop and fabricate a mask communication system for use with the A4 Oxygen Breathing Apparatus (OBA) and a modified Bio-Pak 45 Breathing Apparatus. The latter device has been proposed as a Navy firefighting instructor's breathing apparatus. Firefighters and other Navy Damage Control personnel, who are required to wear breathing devices, are severely limited in the work effectiveness due to inadequate communications. The masks they are required to wear degrade the speech to such an extent that it is unintelligible, especially in the high ambient noise environments inherent with their work. In these high noise levels, the voicemitters in the masks are completely ineffective. A communication system was developed that gives a speech projection capability to the wearer, permitting a high degree of aural intelligibility over extended distances, in high ambient noise environments.

485. Audet NF
VISOR SYSTEM MATERIALS FOR ALUMINIZED FIREMEN'S HOODS. REPORT 2: EVALUATION OF GOLD COATED PLASTIC SUBSTRATES. Navy Clothing and Textile Res Unit, Natick, MA; TR-113-Rept 2, 54 pages, Jun 1975
Availability: NTIS AD-A015 310

The Navy Clothing and Textile Research Unit became concerned with the poor durability characteristics of the gold-coated facepiece component of the crash-crew firefighter's visor system and established a program to identify the problems associated with the facepiece. Several experimental transparent plastic sample materials were obtained, uncoated, gold coated, and gold coated and overcoated with different types of protective overcoatings, and evaluated to determine the following: Heat transmission characteristics of the uncoated transparent plastic substrates; heat transmission characteristics of the gold coatings with and without the different types of overcoatings on the transparent plastic substrates; durability characteristics of the coated materials.

486. Ohlbaum MK and Kissen AT
EFFECT OF PROPOSED B-1 PROTECTIVE SMOKE HOOD ON VISUAL PSYCHOMOTOR PERFORMANCE. Wright-Patterson AFB, OH, Aerospace Med Res Labs; AMRL TR-75-55, 9 pages, Aug 1975
Availability: NTIS AD-A015 733

Potential in-flight emergencies on contemporary aircraft include smoke in the cockpit even without patent fire. In order to avoid eye irritation, the use of a plastic hood to isolate the face of the aviator from the smoke has been proposed. Investigation of visual psychomotor performance indicates that the hood may be marginally satisfactory for very brief time periods, but completely unsatisfactory and potentially hazardous when in work for five minutes or more. (Author)

487. Kupferman Z and Audet NF
LIGHTWEIGHT ALUMINIZED FABRIC MATERIALS FOR PROXIMITY FIREFIGHTERS' GARMENTS. Navy Clothing and Textile Res Unit; TR-114, 3-74, 34 pages, Dec 1975
Availability: NTIS AD-A020 963/5G

The Navy Clothing and Textile Research Unit (NCTRU) has developed a new lightweight aluminized 10.5-ounce fabric made with cor-spun Novatex-Nomex yarns and a removable quilted insulation liner containing needlepunched Nomex felt as a replacement material for the aluminized 20-ounce asbestos-cotton outershell fabric and quilted wool-batt insulation liner currently used in the standard crash-crew proximity firefighter's outfit. The adoption of the new materials will significantly increase the comfort and efficiency of the firefighter by reducing weight and bulk and enhancing flexibility of the protective clothing. Initial laboratory investigation of comparative heat-protective characteristics of lightweight aluminized fabrics and insulation liners supported the final selection of the aluminized 10.5-ounce Novatex-Nomex fabric and quilted insulation liner containing 7-ounce Nomex felt. Analysis of laboratory data on the physical properties of the aluminized Novatex-Nomex material indicated it had excellent potential as a substitute fabric for the current standard material. A small semi-production run was made on both the outershell and the insulation materials and the materials were manufactured into experimental prototype garments. Examination of prototype garments worn for 3 months showed satisfactory durability with no holes, cuts or tears to the outershell fabric nor delamination of the aluminum coating. The quilted Nomex liner laundered satisfactorily with only slight loss in thickness and low shrinkage. Based on these findings, NCTRU recommended the new materials and outfit for adoption to replace the current standard proximity firefighter's ensemble. (Author)

488. Audet NF
VISOR SYSTEM MATERIALS FOR ALUMINIZED FIREMEN'S HOODS. REPORT NO. 1: PROBLEM IDENTIFICATION. Navy Clothing and Textile Res Unit; TR-111, 28 pages, May 1975
Availability: NTIS CSCL 06/7, AD-A011 420

The study determined the durability of the gold-coated facepiece component of the crash-crew firefighters' visor system, because field observations indicated that the gold coating wore off readily. The study examined methods employed by fire station personnel in caring for the facepiece and in replacing it, and the effect of various contaminants and abrasive materials on the quality of the gold coating and its subsequent heat resistance.

489. Sullivan JL
COMPRESSED AIR DEMAND-TYPE FIREFIGHTER'S BREATHING SYSTEM. VOL 1. FINAL REPORT. OCT 1972-SEP 1975. Scott Aviation Corp; NASA CR-144561, ER-1075-Vol-1, 100 pages, Oct 1975
Availability: NTIS CSCL 06K

The commercial availability of lightweight high pressure compressed air vessels has resulted in a lightweight firefighter's breathing apparatus. The improved apparatus, and details of its design and development are described. The apparatus includes a compact harness assembly, a backplate mounted pressure reducer assembly, a lightweight bubble-type facemask with a mask mounted demand breathing regulator. Incorporated in the breathing regulator is exhalation valve, a purge valve and a whistle-type low pressure warning that sounds only during inhalation. The pressure reducer assembly includes two pressure reducers, an automatic transfer valve and a signaling device for the low pressure warning. Twenty systems were fabricated, tested, refined through an alternating development and test sequence, and extensively examined in a field evaluation program. Photographs of the apparatus are included. (Author's Abstract)

490. Sullivan JL
COMPRESSED AIR DEMAND-TYPE FIREFIGHTER'S BREATHING SYSTEM. VOL 2. APPENDICES. FINAL REPORT. Scott Aviation Corp; NASA CR-144562, ER-1075-Vol-2, Rev A, 399 pages, Oct 1975
Availability: NTIS CSCL 06K

The commercial availablility of lightweight high pressure compressed air vessels has resulted in a lightweight firefighter's breathing apparatus. The improved apparatus and details of its design and development are described. The apparatus includes a compact harness assembly, a backplate mounted pressure reducer assembly, a lightweight bubble-type facemask with a mask mounted demand breathing regulator. Incorporated in the breathing regulator is exhalation valve, a purge valve and a whistle-type low pressure warning that sounds only during inhalation. The pressure reducer assembly includes two pressure reducers, an automatic transfer valve and a signaling device for the low pressure warning. Twenty systems were fabricated, tested, refined through an alternating development and test sequence, and extensively examined in a field evaluation program. Photographs of the apparatus are included. (Author's Abstract)

g. PERSONNEL AFFAIRS

491. Coates RJ
INDUSTRIAL RELATIONS AND THE SOCIAL ROLE OF THE FIRE SERVICE
Fire, 68(849):523-524, 1976

Without sound industrial relations all the fire stations, equipment and appliances become useless if there is a major industrial dispute leading to strike. It is advised that the Trade Union and Labor Relations (amendment) Bill being presented to Parliament be studied as a basis for a progressive and democratic fire service. The proposed amendments seek to iron out loopholes of the 1974 act of the same name. The most important issue is whether closed shops will become compulsory, the weight of government opinion tending to preserve the right of the individual to opt out of the union while ensuring that no one receives the benefits of union negotiation without paying for them. Fire brigade management is urged to concern itself with all the industrial and social problems relating to society.

492. Spencer FJ and Breckenridge K
GROUP COUNSELING IN OCCUPATIONAL HEALTH: A SUPPORTIVE MEASURE FOR DISENGAGED FIREFIGHTERS
Exchange, 3(2):51-6, 1975

A description of medical and psychological counseling of some elderly firefighters of the Forest and Fire Warden Dept of the County of Los Angeles (USA) is presented. This group contained a fair number of men with a preliminary diagnosis of heart disease.

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

a. COMMUNICATIONS AND SIGNALLING

493. Anon
HOUSTON TAPS MODERN TECHNOLOGY FOR COMMUNICATIONS, DISPATCHING
Fire Eng, 129(1):20-21, 1976

Houston's expansive system, consisting of a five-story police communications center, a fire alarm building, a central transmission site, six relay-repeater stations, 41 additional operating frequencies, 631 new mobile radios, and modifications to buildings and new equipment at 59 fire stations, inaugurated operations in October, 1975. Houston is planning for the application of additional available technology, but has elected to first implement a system framework designed specifically for such applications and to accommodate foreseeable growth. 2 figs.

494. Anon
ALARM SYSTEM BUILT FOR FUTURE EXPANSION
Fire Chief, 20(3):39-41, 1976

The new communications system in Houston, TX, installed in Oct, 1975, was designed with the future in mind. The key components of the project are a five-story police communications center, fire alarm building, central transmission site, six relay-repeater stations, 41 additional operating frequencies, 631 new mobile radios, and modifications to buildings and new equipment at 59 fire stations. The basic system can be expanded and can accommodate all known technology; for example, the UHF dispatch channels can be tripled, antenna combiners may be used to triple the number of receivers, the capacity of the VHF microwave links will permit the use of space diversity configuration, the 960 MHz fire alarm transmitter has reserve capacity for additional programs, and video capacity can be obtained by adding a parallel 2 GHz microwave circuit. 2 photos.

495. Brushlinskiy NN and Pranov BM
DETERMINING THE NUMBER OF SPECIAL COMMUNICATION LINES FOR CITIES
Vopr ekon pozhar okhrane, (3):102-110,

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION
a. Communications and Signalling

1974 (Russian)

A quantitative estimate of the flow density of calls to the fire communications center is made. A method is given for calculating the number of special "01" telephone communication lines required for effective operation of the fire communications center of a city. (Author)

496. Anon
NEW COMPUTERIZED COMMUNICATIONS
Fire Command, 42(6):34-5, 1975

A new communications center equipped with modern computers costing a total of 185,000 dollars is being completed in Montgomery, Ala. This center will monitor 400 existing direct-voice fire alarms, identifying each signal, displaying each on the panel and reporting the address of the fire site. The existing telephone communication system will be replaced by an electronic data transmission system in which the report is recorded on a color cathode ray tube with street, house number and type of alarm entered. Data on the residential and commercial structures being monitored in the city will be stored in the computer memory. When a fire alarm is received, the center's electronic communication equipment alerts the fire company and gives it information on the presence of invalids, storage of hazardous materials, the location and flow rate of the nearest fire hydrants, the best route to the call site, and other useful information. The equipment also gives a visual display of the personnel and resources available for fighting the fire and permits maintenance of contact with mobile fire radio stations. The information necessary for operating the new center is now being gathered. The old communications center has been moved temporarily to a different site without interruption of operations.

b. EXTINGUISHING AGENTS AND ADDITIVES

497. Anon
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 3 (Peny. Poluchenie i Primenenie. Materialy Vses Nauchn-tekhn Konf. Ch 3)
Moscow, USSR; 98 pages, 1974 (Russian)

Part 3 is devoted to the "Methods of Production and Range of Application of Foams". The conference was held at the All-Union Fire Protection Res Inst under the sponsorship of the Nat Comm of the USSR on Surfactants, the Central Fire Protection Admin of the USSR, the All-Union Fire Protection Res Inst and the Phys Inst of the Acad Sci USSR. Representatives from 25 scientific research institutes and from ministries and agencies participated in the conference. The experience gained in the production and use of foams in fire fighting was correlated. The principal trends were outlined and arrangements were made to coordinate work in this field. Part 1 of the papers was devoted to the "Physics and Chemistry of Foams", Part 2 to "The Use of Mechanical Foams and Wetting Agents to Extinguish Fires". Abstracts of these two parts and of Part 3 can be found by consulting the Source Index under "Conferences".

498. Kimstach IF
EXPERIENCE AND OUTLOOK FOR THE USE OF FOAMS AND WETTING AGENTS IN FIRE SUPPRESSION
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 1; 1974, All-Union Fire Protection Res Inst, Moscow, pages 64-75
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The results of the use of medium-expansion foams in fire departments all over the country are analyzed. The advantages of foam fire suppression and the deficiencies in organization efforts to expand the use of foam are identified. (Author)

499. Gorkunenko VM and Kazakov MV
ACCELERATED METHODS OF DETERMINING THE STORAGE LIFE OF FOAM COMPOUNDS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 1; 1974, All-Union Fire Protection Res Inst, Moscow, pages 155-160
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

Considered are accelerated methods of determining the storage life of foam compounds; it is calculated from the rate constants of the chemical reactions that take place with the compounds. The storage life of various foam compounds is given. (Author)

500. Kazakov MV, Gevlich Vn, Karpov VI, Bilkun DG, Belyaev VM and Gaevoy GM
TESTING THE FIRE-EXTINGUISHING EFFICIENCY OF SURFACTANTS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 10-18
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The foam-making and wetting properties of five types of surfactants are investigated. The surfactants tested are recommended for the production of medium-expansion foam and for the suppression of petroleum-product fires. (Author)

501. Taradayko VP, Gurinova EL, Veselov AI and Makarov KN
CONTRIBUTION TO THE PROBLEM OF EXTINGUISHING SOLID CHEMICALS BY AQUEOUS SOLUTIONS OF SURFACTANTS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 25-29
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The use of 1 percent solutions of a mixture of a hydroxyethylated derivative of benzamine and butyl carbitol to extinguish solid chemical materials containing an oxidizer increases the fire-extinguishing capability of water by a factor of about 3. (Author)

502. Timofeev NV
USE OF SURFACTANTS TO EXTINGUISH FIRES IN THE DONETSK REGION
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 30-34
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

In the Donetsk region new surfactants are being sought and the possibility of using them to extinguish fires is being studied. The addition of such compounds as Prevocell, Arcanol and ethyllaurene to water increases its fire-extinguishing capability by a factor of 2.0 to 2.5. (Author)

503. Kulakovskiy AA
MEDIUM-EXPANSION MECHANICAL FOAM - AN EFFECTIVE FIRE EXTINGUISHANT
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 59-63
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

Examples are presented of the effective use of medium-expansion foam to extinguish fires in confined spaces and overflowing petroleum-products fires that occurred in the Moscow District in the period 1971-1973. (Author)

504. Belash VD, Vostryakov VI and Fukalov VG
THE USE OF MEDIUM-EXPANSION FOAM IN SHIP MACHINE COMPARTMENTS
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 109-116
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The influence of the temperature of the gas medium pumped out by the foam generator on its expansion is studied. It is found that an elevated temperature reduces the expansion of the foam; as a consequence, the fixed installations in ship machine compartments must be supplied with fresh air. (Author)

505. Volkov MP, Vostryakov VI, Kotov AA and Fukalov VG
EXTINGUISHING SHIP MACHINE COMPARTMENT FIRES WITH 1000-X FOAM
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow, pages 117-125
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of

the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The experience gained in extinguishing diesel fuel fires in the machine compartment of the tanker "Tsuryupo" has made it possible to establish standard indicators for the design of fixed high-expansion foam fire-extinguishing systems. The calculated foam delivery rate was 1.5 l/min per m² maximum machine compartment area. (Author)

506. Volkov MP and Malofeev NI
INVESTIGATION OF THE PHYSICAL PROPERTIES OF MECHANICAL FOAM
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 1; 1974, All-Union Fire Protection Res Inst, Moscow, pages 161-167
Sponsor: Nat Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Phys Inst Acad Sci USSR

The structural parameters of foams that affect its fire-extinguishing properties are examined, such as the strength of the foam or its resistance to vapor-gas penetration, lifetime (stability), and vaporizability. It is found that the lifetime, viscosity and vapor-gas impermeability increase with increasing dispersibility of the foam, which in turn increase the effectiveness of the fire-extinguishing systems. (Author)

507. Anon
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 1 (Peny. Poluchenie i Primenenie. Materialy Vses Nauchn-tekhn Konf. Ch 1)
Moscow, USSR; 185 pages, 1974 (Russian)

Part 1 of the conference papers is devoted to the "Physics and Chemistry of Foams." The conference was held at the All-Union Fire Protection Res Inst in Moscow under the sponsorship of the National Com of the USSR on Surfactants, associated with the Internat Com on Surfactants, the Central Fire Protection Admin of the Ministry of Internal Affairs of the USSR, the All-Union Fire Protection Res Inst, and the Physics Inst of the Academy of Sciences of the USSR. Representatives of 25 scientific research institutes and specialists from the ministries and agencies participated in the conference. The experience gained in studying foams was correlated. The principal trends were outlined and arrangements were made to coordinate work in the field. (See following entry for Part 2.) Consult the Source Index under "Conferences" for a complete listing of the papers abstracted in FTA.

508. Anon
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2 (Peny. Poluchenie i Primenenie. Materialy Vses Nauchn-tekhn Konf. Ch 2)
Moscow, USSR; 146 pages, 1974 (Russian)

The reports of Part 2 (The Use of Mechanical Foams and Wetting Agents to Extinguish Fires) presented at the conference, which was held at the All-Union Fire Protection Res Inst in Moscow, are given in full. The results of tests of various surfactants and of the practical use of foams and wetting agents in fire suppression are examined. The sponsoring agencies were the Nat Committee of the USSR on Surfactants, associated with the Internt Com on Surfactants, the Central Fire Protection Admin of the Ministry of Internal Affairs of the USSR, the All-Union Fire Protection Res Inst, and the Physics Inst of the Acad of Sciences of the USSR. Some of the papers are separately abstracted (see following entry). Consult the Source Index under "Conferences" for a complete listing of the papers abstracted in FTA.

509. Minaev SN and Utkina ZH D
FOAM FORMING AND WETTING AGENTS IN FIRE PROTECTION
Foams. Production and Application. Papers of the All-Union Scientific and Technical Conference. Part 2; 1974, All-Union Fire Protection Res Inst, Moscow
Sponsor: National Comm of the USSR on Surfactants, Central Fire Protection Admin of the USSR, All-Union Fire Protection Res Inst, and Physics Inst of the Acad Sci USSR

Statistical data are presented on the use of mechanical foams and wetting agents in fire suppression in the USSR in 1967-72, as well as in some autonomous republics and regions. The requirements for foam-forming agents in the near future are determined. (See preceding entry.)

510. Tatem PA, Gann RG and Carhart HW
PRESSURIZATION WITH NITROGEN AS AN EXTINGUISHANT FOR FIRES IN CONFINED SPACES. II. CELLULOSIC AND FABRIC FUELS
Combust_Sci_Technol, 9(5/6):255-9, 1975

Laboratory experiments on pressurization with nitrogen for suppressing fires in gastight spaces have been extended to solid fuel combustion. Flames from fabric and cellulosic fires in a 9.6 ft^3 chamber were quenched by the addition of a quantity approximately equal to or less than 0.5 atm of nitrogen. Several samples of each fuel were allowed to burn to self-extinguishment in the closed chamber to ascertain the true effectiveness of the technique in halting the production of noxious gases. By comparison with these unattended fires, it was shown that the depletion of oxygen was terminated quickly and the gross buildup of noxious gases was significantly repressed by nitrogen pressurization, leaving a habitable postfire atmosphere. 5 tables, 11 refs. (Author's Abstract)

511. Schmitt CR
CARBON MICROSPHERES AS EXTINGUISHING AGENTS FOR FISSIONABLE MATERIAL FIRES
Fire_Technol, 11(2):95-8, 1975

Controlled fire tests were made with 50-gram quantities of pyrophoric uranium metal powder to assess the relative degree of airborne contamination associated with the burning and extinguishing of this material using standard high-volume air monitoring equipment. By applying carbon microspheres for extinguishment, the airborne contamination was reduced considerably. 2 figs, 4 refs. (Author's Abstract)

512. Emel'yanov AP
"VISCOUS" WATER
Pozhar_Delo, (4):23, 1975 (Russian)

The author describes the advantages of the "viscous" water used for extinguishing fires and gives details of the tests made with a 0.05 percent solution of sodium carboxymethylcellulose. The tests were also made using viscous water for the production of high expansion foam. 1 table. [Safety in Mines Abstracts]

513. Emel'yanov AP
THE INFLUENCE OF ENHANCING THE FIRE-EXTINGUISHING EFFECTIVENESS OF WATER ON FIRE LOSS REDUCTION
Tr_Inzh-ekon__Fak__Rizh__Politekhn_In-ta, (4):141-6, 1974 (Russian)

The results of research aimed at increasing the fire-extinguishing capability of water by adding sodium carboxymethylcellulose are given. A close connection is found between the effectiveness of the fire extinguishant and fire losses.

514. Stauffer E
EXTINGUISHING TOLUENE DIISOCYANATE FIRES WITH DRY CHEMICALS
Fire_Technol, 11(4):255-60, 1975

The author reports on a testing program undertaken to find the answer to the question whether reactivity of toluene diisocyanate with certain entinguishing agents is a significant problem. Three series of fire tests were performed - two outdoors and one indoors in the laboratory. The initial series employed a 5-ft^2 pan, 45 pounds of TDI, and a 10-pound fire extinguisher containing the test agent. This series was documented on video tape. 5 figs.

515. Volkov MP
METHODS OF DETERMINING THE EXPANSION RATIO OF HIGH-EXPANSION FOAM
Sb_Tr_VNII_protivopozhar_oborony, (5):75-79, 1974 (Russian)

The various methods of determining the expansion ratio of foams are analyzed: by weight, volume, electrical conductivity, light opacity, viscosity, sound conductivity and permeability to alpha and beta rays. It is concluded that the volume and weight methods are the best methods. (Author)

516. Volkov MP and Fukalov VG
STUDY OF THE POSSIBILITY OF DISCHARGING HIGH-EXPANSION FOAM THROUGH PIPES
Sb_Tr_VNII_protivopozhar_oborony, (5):80-83. 1974 (Russian)

The reduction in output of high-expansion foam generators when the foam is discharged through pipes is determined. Under the experimental conditions (discharge to 20 m) the output of the generator was reduced by 6 to 30 percent as a function of the pipe material and the ventilator pressure head. (Author)

517. Kozlyuk AI, Grin GV, Gavrish YuV and Kharlamov BN
DETERMINING THE CONCENTRATION OF FIRE-DAMPING POWDER IN A VENTILATED MINE WORKING
Gorno_spasat_delo, (10):30-32, 1975 (Russian)

The results of the movement of a firedamping powder in a ventilated mine working after discharge from a fixed powder system are discussed. Formulas are presented for estimating the concentration of the gas-powder mixture and the mass of powder deposited at an arbitrary distance from the atomizer as a function of the time the system begins operating. 1 fig, 2 refs. (Author)

518. Kushnarev AM, Rybalko SF and Ovcharov EA
INTENSITY OF APPLICATION OF MECHANICAL FOAM TO EXTINGUISH COAL-OIL MIXTURES
Gorno_spasat_delo, (10):20-22, 1975 (Russian)

The dependence of the time of extinction of a burning coal-oil mixture on the intensity of application of the foam is determined experimentally. For practical calculations a foam application intensity of 25-30 liters per second for a 1 m(2) area is recommended; at this rate the extinction time does not exceed one minute. (Author)

519. Shetser GM, Kushnarev AM, Rybalko SF, Petrovskiy VB and Manzyuk ES
INFLUENCE OF THE TEMPERATURE OF COMBUSTION PRODUCTS ON FOAM GENERATION AND PROPERTIES
Gorno_spasat__delo, (10):3-7, 1975 (Russian)

When the temperature of the combustion products ejected by a foam generator increases to 70-100°C, the expansion rate of the foam decreases sharply; as a result, the output of the foam generator also decreases. At the same time, the separation of liquid from foam intensifies. Disintegration of the foam in volume is accelerated slightly, but intensification of syneresis results in deterioration of the fire-extinguishing capability of the foam. These factors must be taken into account when designing fixed foam extinguishing systems. 3 figs. (Author)

520. Sims IJ
WHEN STEAM IS THE BEST EXTINGUISHANT
Fire_Eng_J, 36(101):18-21, 1976

Steam is considered to be a superlative fire control and extinguishing medium and is extensively used in the petroleum, petrochemical and allied industries. The various fire applications of steam in blowthrough, blowdown, snuffing, steam lances, sump protection, regeneration, gas dispersal and dilution, blanket, rings, and purging are examined. 1 fig.

521. Broell R
NEW MECHANICAL FOAM FIRE-EXTINGUISHING AGENTS
VFDB_Z, 25(2):60-61, 1976 (German)

This article considers results of investigations of aqueous foams consisting of mixtures of synthetic foams and foams with a protein base. It is concluded that foams with a synthetic base, regardless what type, and protein foams, including those containing a fluoride, must be stored separately. In particular, care must be taken to avoid mixing traces of synthetic foams with protein foam or fluorine protein foams. 4 figs. (Author)

522. Fiala R and Dussa K
FIRE FIGHTING AGENTS FOR LARGE AIRCRAFT FUEL FIRES; Paper No. 21
Aircraft_Fire__Safety,__AGARD__Propulsion and_Energetics_Panel_Meeting,_45th,_Proc, Oct_1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

For a critical evaluation of the properties of the different types of agents, experiments were carried out using standardized small and large fuel fires (4 sq m and 200 sq m). The time until extinguishment occurred and the amount of agent needed were measured. Additionally, the time which elapsed after a deliberate reignition until the whole fuel surface was on fire again was measured. Results are discussed. 10 pages, 5 figs, 2 refs. (Author)

523. Nash P
THE EXTINCTION OF AIRCRAFT CRASH FIRES; Paper No. 22
Aircraft_Fire__Safety,__AGARD__Propulsion

and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The problems are discussed of aircraft crash fires, including the difficulty of arrival of the fire-fighting services in time to save life. The different fire fighting agents available are appraised. Fire fighting foams are shown to be the only satisfactory primary fire fighting agents for major crash use. The research and development of foam liquids and the means used to assess their performance are discussed in terms of the physical properties of the foam liquid. The development of foam making equipment and appliances in order to put the foam liquid to best use to meet the operational requirement is examined. 13 pages, 13 figs, 8 refs. (Author)

524. Fiala R, Dussa K and Winterfeld G
ON THE APPLICABILITY OF RETICULATED FOAMS FOR THE SUPPRESSION OF FUEL TANK EXPLOSIONS; Paper No. 16
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The flame suppression properties of polyurethane foams with varying cell size were studied by means of a flame tube and an explosion vessel. Results on the thickness of the foam layer necessary for flame quenching are given, depending on pore size, fuel-air ratio, and on pressure. The behavior of reticulated foam during explosion in a closed vessel is discussed, as well as its mechanical behavior. Conclusions with respect to the application of foam structures in tanks are presented. 12 pages, 7 figs, 2 refs. (Author)

525. Seeger PG
A LABORATORY TEST METHOD OF EVALUATING THE EXTINGUISHING EFFICIENCY OF DRY POWDERS; Paper No. 24
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The laboratory test method of evaluating the extinguishing efficiency of dry powders is based on the burning velocity of a laminar premixed methane-air flame. The dry powder being tested is fed into the premixed fuel gas-air flow by a vibrating chute. The powder particles reach the test flame and reduce the burning velocity, more or less depending on their extinguishing efficiency. The burning velocity is determined by the nozzle method and by schlieren photography. The evaluation of the measurements shows that the square of the burning velocity is a linear function of the mass flow of the dry powder fed into the fuel gas-air flow. The theoretical minimum value of the mass flow of the dry powder necessary to extinguish the test flame may be determined by the slope of the straight line. 9 pages, 8 figs, 2 tables, 8 refs. (Author)

526. Thorne PF, Theobald CR and Mahendran P
DRAG REDUCTION IN FIRE HOSE TRIALS AT FIRE SERVICE TECHNICAL COLLEGE 1974. Part I. EXPERIMENTS AND RESULTS. Middlesex Polytechnic, Hendon (UK), Mechanical Eng Dept; Fire Res Note 1033, 35 pages, May 1975

This note describes trials of a commercially-available system for injecting drag reducing additives into fire-fighting water and presents measurements of the friction factors of a range of UK fire hose made using the system.

Reductions were found in friction factor of 70 per cent for 3/4 inch hose reel hose, 50 per cent for 1 3/4 inch and 2 3/4 inch hose and 20 per cent for 3 1/2 inch hose. (Author's Abstract)

527. John R
INFLUENCE OF AIR AND WATER TEMPERATURES AS WELL AS AIR AND WATER IMPURITIES ON THE GENERATION OF FIRE EXTINGUISHING FOAMS; AGF 23, 42 pages, 25 figs
Availability: Res Office for Fire Protection Eng, Karlsruhe Univ, Germany

Four protein and five multiple foam compounds with an alcohol base were used to produce a low-expansion foam with a "Baby-Komet" nozzle. The characteristics, expansion ratio, water half-life and combustion time were determined from these foams. The effect on the foam characteristics of varying air and water temperatures, water hardness, impurities and additives in the foam-producing air are investigated. The results are displayed graphically.

The foam characteristics are greatly altered by high water temperatures and by impurities in the air from smoldering wood gas and oil mists. In practice, smoke gases can contain similar components and, if they are sucked into the foam nozzle along with the air, they can result in such poor foam quality that the extinguishing effect becomes questionable. The present study also showed that it is absolutely necessary to determine the temperature of the foam-producing solutions and the hardness of the water in order to verify or define the foam characteristics. In addition, the foam-producing air must be completely free of impurities or additives during tests, because otherwise it is not possible to compare the characteristics of the different foam compounds. (Author's Abstract)

528. Thorne PF
DRAG REDUCTION IN FIRE-FIGHTING. Building Res Estab (UK), Fire Res Station; BRE CP-70-75, 10 pages, 7 figs, 18 refs, Aug 1975

The potential uses of drag reduction in practical firefighting operations are discussed. Experiments in which friction factors for 70 mm fire hose have been measured are described. Drag reduction of 50 to 60 percent at Reynolds numbers 10^5 to 4 x 10^5 was found and strong evidence of a diminution in drag reducing effect at high Reynolds numbers seen. The results, which are in line with other published results for 'rough' pipes, are discussed in relation to theory. The effect of polyethylene oxide on water jets is shown as a damping of turbulent eddies, the nozzle profile being of equal importance in improving the coherence of firefighting jets of water. (Author's Abstract)

529. Thorne PF and Tucker DM
THE DEVELOPMENT OF AN IMPROVED DRY POWDER - FIELD TRIALS. Dept of the Environment and Fire Offices' Committee (UK), Fire Res Sta; Fire Res Note 1042, 8 pages, 2 figs, 2 tables, 4 refs, Nov 1975

The results of Class A and B fire tests using an experimental powder based on mono-ammonium phosphate of tailored particle size distribution are described.
The experimental powder was found to be comparable with commercially available general purpose powders on Class A fires and more effective than sodium bicarbonate powders on Class B fires. (Author)

530. Eberly R
THE EFFECTIVENESS OF 'FIRE GAS RECIRCULATION' EXTINGUISHING SYSTEMS ON SHIPBOARD MACHINERY SPACE FIRES. PHASE II. Coast Guard Res and Dev Center; CGR DC-32-75, USCG D-187-75, 71 pages, Jan 1976
Availability: NTIS AD-A020 979/1GA

This report details a series of tests conducted at the US Coast Guard's Fire and Safety Test Facility in Mobile, Alabama, to further evaluate the extinguishing capabilities of the machinery space fire gas recirculation network installed onboard the M/V RHODE ISLAND. This additional test program was designed to examine the empirical relationships of certain factors relevant to the combustion environment. As in the previous test series, full scale fires were started in the machinery space of the M/V RHODE ISLAND, which was then successfully extinguished by actuation of the installed fire gas recirculation networks. In addition to parameters evaluated in the first test series, the following three factors are also noted: 1) pre-burn length vs control time; 2) free vent area vs control time, and 3) recirculation volume vs control time. To perform these tests, additional ventilators, power blowers, and cross-link ducting were installed in the top of the machinery space casing, and additional gas sampling equipment and instrumentation provided. (Author)

531. Alger RS, Laughridge FI, Wiltshire LL, McKee RG and Johnson WH
AIRCRAFT GROUND FIRE SUPPRESSION AND RESCUE SYSTEMS. BASIC RELATIONSHIPS IN MILITARY FIRES, PHASE 4; HIGH-SPEED DISSEMINATION OF DRY CHEMICAL FIRE SUPPRESSION AGENTS. FINAL TECHNICAL REPORT, MAR-NOV 1974. Wright-Patterson AFB, OH, DoD Aircraft Ground Suppression and Rescue Office; DoD AGFSRS-75-3, 63 pages, May 1975
Availability: NTIS AD-A014 227

The feasibility and effects of applying dry chemical fire suppression agents at very high rates were explored with a series of cascade and pool type jet-fuel fires. Powders were dispensed at conventional rates with hand held extinguishers and at high rates with a rocket motor type dispenser. Typical discharge conditions with the high speed dispenser are described, along with fire sizes and effectiveness. (Author)

532. Alger RS and Capner EL
AIRCRAFT GROUND FIRE SUPPRESSION AND RESCUE SYSTEMS. BASIC RELATIONSHIPS IN MILITARY FIRES. PHASES 3,5,6 and 7. FINAL TECHNICAL REPORT, OCT 1971-NOV 1974. Nav Surface Weapons Center, White Oak, MD; DoD AGFSRS-75-4, 158 pages, May 1975
Availability: NTIS AD-A014 228

The suppression of class B fuel fires with aqueous film forming foam was studied as a function of fuel, environment, and mode of agent application. Cooling, insulating, and isolating the fuel were examined as functions of conventional foam quality parameters, such as expansion ratio, drainage rate, and agent concentration. In field tests on fires ranging in area from 1500 to 48,000 sq ft suppression efficiency and burnback protection were measured as a function of foam quality and mode of application from various crash trucks. Yardsticks were defined to evaluate the efficiency of equipment and techniques, and two simple extinguishment models were developed.

c. HYDRAULICS AND WATER SUPPLIES

533. Manno AD
MASTER STREAM FOR HIGH-RISE FIRES
_Fire_Eng_, 129(1):22-23, 1976

Standpipes, required for tall buildings, are the only means to deliver fire flow and rescue occupants, but seldom work correctly the first time. Standpipe tests should be required before occupancy on all new construction. Test methods are described. Basic strategy and tactics for rescue and fire control in highrise buildings are outlined. 2 figs.

534. Ivanov EN
STATISTICAL ANALYSIS BY COMPUTER OF THE OPERATION OF FIRE-FIGHTING WATER SUPPLY SYSTEMS
_Vopr__ekon__pozhar__okhrane_, (3):95-101, 1974 (Russian)

On the basis of an analysis of the operation of fire-fighting water supply systems mathematical models are constructed to assist in describing, explaining and predicting processes and phenomena in these systems. (Author)

535. Hughes RT and Matthews RH
FOUR-WAY HYDRANT VALVE
_US_Patent__No.__3,871,614_, Cl 251-104, (F16k 35/00), Appl 26 Nov 73, Discl 18 Mar 75

The patent is for a 4-way cntrol valve designed primarily for installation on fire-extinguishing distribution lines (e.g. in fuel storage tank parks). The valve consists of a main chamber, with inlet and outlet diameter approximatley 115 mm, a 63-mm diameter bypass line with connecting branches for hoses and, at the center of this line, an outlet to the main chamber (ahead of the lock section), the valve unit, which closes the outlet in the bypass line when the pressure at the inlet to the bypass exceeds the pressure in the main chamber. A description of the valve structure and of its operation is given. 9 figs. (Author)

d. INSPECTION

e. OPERATIONAL PROBLEMS

536. Semikov VL
PROBLEMS INVOLVED IN SETTING UP AN AUTOMATIC CONTROL SYSTEM FOR FIRE PROTECTION
_Vopr_ekon__pozhar__okhrane_, (3):118-128, 1974 (Russian)

The problems that can be solved using automatic fire-protection control systems are outlined. (Author)

537. Evers H and Drebinger K
SYSTEM EZ 2000 COMPUTER-ASSISTED COMMAND AND CONTROL CENTERS FOR THE FIRE SERVICE
_Siemens_Z_, 49(12):773-778, 1975 (German)

The steady rise in demand for assistance from the fire service, of which fires constitute only 10 percent of the responses, has made it necessary to equip command and control centers with data processing units, relieving the dispatcher by providing him instantly with logistical, tactical and operational information from the data bank. The EZ 2000 System developed by Siemens for this process is described and illustrated with operational diagrams. The system is now in operation in Augsburg. 6 figs, 2 refs.

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

e. Operational Problems

538. Scholz W

COMMANDING LARGE SERVICE UNITS

VFDB Z, 25(1):1-9, 1976 (German)

As demonstrated by large-scale fires in the past, the command and fireground control of several firefighting units requires greater attention than hitherto devoted to this problem. The responsible fire chiefs will be nominated in the light of these aspects and the ability to lead large units. Such a capacity will be a decisive factor in successfully fighting disastrous fires. This is the problem confronting the command staff of modern fire service organizations. An effort should be made toward a uniform solution to the problem, to which this paper is intended as a contribution. 6 figs, 6 refs. (Author's Abstract)

f. PUBLIC EDUCATION AND PUBLIC RELATIONS

539. Meldrum J

PUBLIC RELATIONS IN THE FIRE SERVICE

Fire Eng J, 36(101):15-16, 1976

Public communication has so permeated contemporary life that no organization can live in isolation. The fire service is not exempt from this development and, to respond correctly, must have direction. For this purpose the author proposes a scheme for the organization of a public relations office, outlines the tasks to be performed by the public relations officer, and evaluates the necessity and value of the effort.

540. Anon

EXPLORING - FIRE DEPARTMENT YOUTH PROGRAM

Fire Chief, 20(3):35-37, 1976

"Firematics Exploring" is a popular arm of the Boy Scouts of America program for 14- to 21-year olds which today is attracting nationally some 6,500 young people in 440 posts, most of them run in partnership with paid or volunteer departments. The various activities undertaken in this program are discussed, among them hauling hose, assistance with air packs, controlling crowds, manning radios, hydrant hook-up, washing apparatus, book work, becoming proficient in first aid, handling small lines, etc. Other activities, such as summer tournaments among posts and disaster drills, are also described. 3 figs, 1 table.

541. Zuccarelli LA

THREE DIFFERENT FIRE SAFETY PROGRAMS

Fire Eng, 129(4):63-66, 1976

The author, associate professor in the fire science program of Northern Virginia Community College, proposes three fire safety education programs for the general public. The first program is a fire safety awareness program to be mandatory after two-time code violations, either by court referral or by local fire prevention bureau mandate. The second program is a homeowners' fire safety program developed in cooperation with insurance carriers with the possible incentive of insurance rate reduction. The third program is designed for multi-family dwellings and their managers by way of clauses making attendance at such a program mandatory.

542. Casey J

BUILDERS, ARCHITECTS, PLANNERS, DESIGNERS CONFER ON FIRE SAFETY EDUCATION

Fire Eng, 129(4):33-36, 1976

Fire safety education and training was the theme for a conference conducted by the National Fire Academy of the National Fire Prevention and Control Admin at the Univ of California, Berkeley, on Jan 26-28, 1976. The program was structured around four forum panels, architects, urban planners, interior designers, and builders, each with a panel leader.

The architect panel called for the NFPCA to run a teacher-training program with the Amer Inst of Architects to act as a developer of a sample model curriculum, to set up an information clearinghouse for materials and curricula, and to establish a system of fire-safety incentive awards.

The major position defined by the urban planning panel was a need to increase the awareness and involvement of practicing urban planners in the fire protection field.

The builders' panel called for a four-part educational program directed to builders, contractors and related groups in advancing levels from trademan-apprentice through two-year community college to a four-year baccalauriate program.

The interior designers' panel recommended that the NFPCA be the resource center for profession-related materials in the design field and that a newsletter indicate the availability of data and abstracts.

543. Hemmeter PA
PRESS RELATIONS AND THE FIRE SERVICE
Fire_Chief, 20(5):29-32, 1976

The role of a press officer requires knowledge and behavior patterns foreign to most firefighters, who will nevertheless be required to function in this capacity, certainly those who reach the top positions in their departments. Tips on public relations from a firefighter with newspaper experience are presented. 2 figs.

544. Pabst S
THE PUBLIC IMAGE OF THE FIRE DEPARTMENT
Brandschutz, 30(5):110-114, 1976 (German)

In a speech given at a local and district fire chief's conference of the State Fire Fighters's School of Lower Saxony (FRG) a public relations consultant discusses the lack of recognition accorded firefighters by the public and suggests that the reason may be the lack of effective public relations. He proposes an agenda of actions to improve this image by addressing the press with fast, short and concise information, constantly, acting as if they were the newsmakers themselves, ensuring that the news media have access to specialists in case of disaster, that safety be guaranteed, that the information disseminated be correct and complete in all particulars, that rumors and false presentations be suppressed, and that editors feel that the fire department is there to help the newspaper or TV.

545. Leese A
EDUCATION IN FIRE SAFETY IS EVERYONE'S CONCERN
J_Br__Fire__Serv__Assoc_and_Ind_Fire_Prot Assoc, 3(4):154-155, 1975

After the 1948 reorganization of the municipal fire service, interest in the fire protection of industrial enterprises has declined. The work load of the municipal service has grown, while the number of personnel has remained essentially the same, and therefore the capability of the service to assist industry is inadequate; greater attention must be paid to fire-protection measures on the part of industry, commerce and public organizations. The measures taken to reduce the production costs have resulted in a reduction of measures to ensure fire protection.

g. RESCUE OPERATIONS

546. Stapelfeldt JP
FLOWS OF PEOPLE THROUGH EXITS. OBSERVATIONS AND TEST RESULTS
Brandschutz, 30(1):12-16, 1976

The test subjects were 100 young physically fit police trainees; the exit widths were from 0.80 to 1.60 m; the evacuation density was up to a maximum of 8 people per square meter; evacuation speeds were normal, fast (hazardous conditions) and very fast (simulated panic). The data are summarized in two tables with notes. The tests resulted in very fast evacuation times, but the age and physical agility of the test subjects must be taken into account. The safety of people gathered in rooms must be evaluated not only by the maximally short evacuation time, but also by the hindrance offered by the evacuation routes (such as projections). Suggestions are made with regard to exit widths for evacuation densities, the risk of falling after passing through the exit, and the risks of handles and projections. The possible rescue time was calculated by the scientific methods of Predtechenskiy and Milinskiy. 5 figs, 2 tables, 1 ref.

547. Lathrop JK
TWO FIRES DEMONSTRATE EVACUATION PROBLEMS IN HIGH-RISE BUILDINGS
Fire_J, 70(1):65-70, 1976

Two recent (1975) fires in the World Trade Center and the Squibb Building in New York City and some of the problems involved in controlling building occupants during fires in high-rise buildings are discussed. Fire remoteness of exits, deadend corridors, fire exposure of stairways, smoke movement through duct work, installation of fire doors in corridors and the need for convincing fire-alert messages through public address systems were the problems identified in the discussion. 2 figs, 7 photos, 1 ref.

548. Bloom F
HELICOPTER RESCUE SERVICE STARTED ON LOW BUDGET IN LEE COUNTY, FLA
Fire_Eng, 129(6):24-25, 1976

The process of establishing the helicopter rescue service at minimal cost amounted to judicious acquisition, borrowing and installation of surplus material, as well as purchase of certain items. The Department of Aviation was then formed as part of the Division of Protective Services, consisting of two Bell TH-137 helicopters and a chief pilot. Points to be considered when an air rescue program is proposed are discussed. At the end of the first year of operation, 14 people were alive and well due to the rapid response of rescue teams. 3 photos.

549. Eulenburg P

APPLICATION AND LIMITS OF APPLICATION OF EQUIPMENT FOR THE RESCUE OF PEOPLE FROM BURNING SMOKE-FILLED BUILDINGS

VFDB_Z, 24(3): 101-108, 1975 (German)

Heat, flame and smoke in burning buildings make it difficult or impossible to rescue people. Within a short time people become incapable of applying suitable measures for their own rescue. The operation of devices for the rescue of humans from burning buildings is demonstrated, with particular emphasis on the historical development. The author shows that for normal-height buildings the hazard can be handled using ladders, elevating platforms, life nets, rescue chutes, sliding boards, and rope rescue apparatus. The hazard can be reduced in highrise buildings only by consistent application of preventive structural measures. Such measures must have absolute priority over costs and expenses. 7 figs, 16 refs. (Author)

550. Karlsch D

EVACUATION STUDIES AS THE BASIS FOR THE PLANNING OF ESCAPE ROUTES

VFDB_Z, 24(3): 100-101, 1975 (German)

Research work relating to structural fire protection in West Germany has been devoted mainly to building components and materials. The fire properties of structures as a whole and especially the effects of fire gases on people and their reduction have been inadequately investigated. With government support, scientific study of these factors is being undertaken in several directions, theoretical and practical. The results should lead to suitable suggestions for adequate configuration and structural design of escape routes so that practical rules and regulations can be adopted. (Author)

551. Watanabe Y

A STUDY OF VOICE GUIDANCE FOR EVACUATION

Rep Fire Res Inst Japan, (41):1-7, 1976 (Japanese) (English abstract)

In fires with visibility obscured by smoke, safe evacuation may be possible by utilizing the ability of the human ear to determine direction from a sound source. This study was intended to determine the validity of a few methods for voice guidance of evacuation. The tests were conducted in a 15 x 30 m gymnasium. Blindfolded persons were guided by voice over a distance of 30 meters from the starting point to the sound source, of two kinds, human voice through a loudspeaker and a tape-recorded voice repeating "exit here". The following results were obtained: 1) a person can be guided by the directional sense of his ears even when visibility is obscured. The human voice gives not only instructions but a definite sound direction and is, therefore, an effective evacuation guide: 2) human-voice guidance resulted in less smooth walking than with the tape-recorded voice, speed was essentially the same; 3) when a blind person encounters an obstacle, he grasps its shape by touch to ensure safety and proceeds. When visibility is obscured, the sense of touch plays an important role also. 7 figs, 2 refs. (Author)

552. Fisher JM

RESCUE SLIDE (Raddningsrutschbana)

Swedish Patent No. 374,662, Cl A62b 1/20, Appl 12 Sep 73, Discl 17 Mar 75, Assignee: B.F. Goodrich Co

The slide is intended primarily for the rescue of personnel from floating oil-extraction platforms. It is a slide chute running from the platform deck to the water level and is equipped with several cylindrical sleeves of differing diameter made of a textile material coated with an elastomer as sealant. Usually the slide is coiled on the deck of the platform in a housing. When needed, the lower end is let down into the water using a special device, and the sleeves are filled with air. Special braces and spars keep it stable and sloped downward. Inflation is accomplished with six vacuum pumps, which operate off a nitrogen cylinder at a pressure of 140 atm. When turned on, the nitrogen passes through the vacuum pumps via a fast-acting valve and a reduction gear, creating a vacuum in the pump chambers, filling the sleeves with ambient air. A float is attached to the lower portion of the slide; it is kept with the slide and is blown up with nitrogen from a cylinder on the float proper. About 10 sec are required to complete the operation. 8 figs. (Author)

553. Vignon J
HIGH-RISE EVACUATION AND RESCUE DEVICE
French Patent No. 2,225,926, Cl A62b 1/06, Appl 16 Apr 73, Discl 8 Nov 74

A device is patented for the evacuation of people from multi-story buildings in the case of fire. It is a column erected directly adjacent to the building. An endless chain with regularly spaced hooks is affixed to the column. On each floor of the building a special module is installed facing the column. The outer door of the module is opened only when a bracket with a free hook appears opposite it. The evacuee places the ring of his rescue belt over the hook and is lowered to the ground. The free, upward moving side of the chain can be used to lift firemen, medical personnel, and equipment needed to render aid and fight the fire. Two columns can be provided for one row of modules. The principal advantage of the device is that residents of upper floors can be evacuated, since the outer door of an evacuation module located on a lower floor cannot be opened until the floors above it are evacuated. 4 figs. (Author)

h. TACTICS

554. Mendes RF
FIGHTING HIGH-RISE BUILDING FIRES
Nat Fire Prot Assoc, Boston; 153 pages, 1975

The book represents a professional analysis of the tactics and logistics of fighting highrise fires. Attention is focussed on the responsibilities and decision-making needs of command officers. The recent historical development of highrise buildings is reviewed, followed by the factors which create problems. Experiences in a series of highrise fires are documented and the fire control functions needed to control the emergency are outlined. Methods and equipment used by the NYC fire department to improve the handling of certain fire situations are identified. The book also contains excerpts from the special regulations adopted in New York City to increase fire prevention and protection in highrise structures.

555. Barkdull WL
HELICOPTERS FLY EQUIPMENT AND CASUALTIES IN HIGH-RISE TEST
Fire Eng, 129(1):100-101, 1976

Military helicopters were successfully used to transport equipment, remove casualties, place manpower, and conduct observations in a high-rise training exercise held by the Sacramento, Calif, Fire Department. The team concept was developed in a preliminary training session at a six-story apartment building; each member of the department trained in lobby control, stairwell support, fireground control and fire scene operations. The helicopters were obtained through the California Army National Guard. In an actual emergency, the helicopters would have been called through the routine mutual aid channels. Because of the helicopter noise, the exercise showed the need for an internal communications system other than radio. 2 photos.

556. Sylvia R
USING NOZZLES EFFECTIVELY ON 1 1/2-INCH HAND LINES
Fire Eng, 129(4):14-16, 1976

The efficiency of the nozzleman is important in preventing water damage. Advice is given on the use of variable and constant gallonage nozzles, judgement of the gallonage required under various conditions, the use of the nozzle in attack and defense, e.g. to protect the hose crew, and other aspects.

557. Thrasher CL
ATTACK OR DEFEND?
Fire Chief, 20(5):35-38, 1976

Using mathematical calculations of fire flows, the author examines the possibility of attacking large working fires with large volumes of water even though water supply is small. He suggests that controlled burning drills in abandoned buildings could be used to test the theory. 4 figs, 3 tables.

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION
h. Tactics

558. Halpin BM and Hickey HE
NEW AIDS FOR FIREGROUND COMMANDERS
Fire Command, 42(8):56-60, 1975

Graphic representations, hazard information, tactical action plans, and microfiche records have been assembled into three subsystems for fireground command and control: 1) a hand-portable tactics display case containing marked aerial photographs and a magnetic status board; 2) a tactics console, which incorporates a microfiche reader in addition to the tactics case; and 3) a mobile van, which serves as a complete command post with communications equipment and various types of recording equipment, measuring instruments, electronic monitors and status display panels. 4 figs, 1 ref. (Author's Abstract)

559. Andrenucci M
THE USE OF ROCKETS AGAINST CRASH FIRES IN AIRPORT AREAS; Paper No. 20
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975; 1975, Apr 7-11, Rome, Italy
Sponsor: AGARD

The use of rockets is proposed as a means of fighting crash fires, due to their quickness, easy operation, and ability to reach sites not readily accessible by other means. Possible vehicle configurations are discussed along with system operating modes. Details are given of a simulation study, intended for providing the major specifications for the system components performance with respect to efficacy, reliability, and safety requirements. Cost factors are considered. 12 pages, 15 figs. 11 refs. (Author)

9. PLANNING

a. BUDGETING

b. LOGISTICS

560. Bruns W
LOCAL ADMINISTRATIVE REORGANIZATION AND RESULTANT PROBLEMS FOR THE FIRE DEPARTMENT
VFDB Z, 25(2):37-40, 1976 (German)

The principles to be applied by fire departments within the framework of administrative reorganizations to increase the efficiency and balance the budgets of local administrative districts are established on the basis of relevant experience gained by the Hamburg Fire Department. A working team made a structural analysis of units which resulted in a reduction of the personnel of firefighting companies from 20 to 16, mainly by assigning dual functions to some company members. Fire station siting studies using a response-time evaluation of the urban area according to 5 risk classes indicated a reduction by four station houses with, initially, eight station relocations. The model is to be implemented starting in 1976. 3 tables. (Author)

561. Walker WE
USING THE SET-COVERING PROBLEM TO ASSIGN FIRE COMPANIES TO FIREHOUSES
Oper Res, 22(2):275-7, 1975

A heuristic algorithm was used to determine a maximal allocation of tower ladders to each of the five boroughs of New York City. Of the 138 ladder houses in the City, 19 were unable to accommodate tower ladders and 33 houses already had tower ladders assigned to them. It was found that even if all restrictions were ignored, the maximum number of tower ladders that could be deployed without violating the constraint that no alarm box have two tower ladders as its two closest companies is 57. By including the two types of restrictions on assignment, this number is reduced to 45. However, if the Dept were to remove its requirement that all existing tower ladder locations be retained and allow these tower ladders to be reassigned to other locations, the total number of tower ladders that could be located in the City would be 51. This increase of 6 in the number of tower ladders (from 45 to 51) requires the reassignment to new locations of 12 of the 33 tower ladders presently assigned. 3 refs. (Author's Abstract)

562. Rider KL
INTRODUCTION TO A METHOD FOR ALLOCATION OF FIRE COMPANIES
Fire Technol, 11(2):99-110, 1975

One of the most important problems is the allocation of a limited number of fire companies throughout a city. Even if the fire station locations once were suitably chosen, they should be reevaluated periodically, since formerly well protected areas may turn out to be areas of increasing fire hazard, and vice versa. A fundamental criterion in allocating fire companies is the travel time. Ideally, the fire department might like to minimize the average travel time to fires throughout the city while providing equal average travel times in all areas of the city. As a rule, both requirements cannot be satisfied simultaneously. In practice, some compromise solution must be adopted, with both aims in mind, in order to get a reasonable allocation of fire companies. A method of finding this compromise solution is presented, based on estimations of fire hazards, alarms, workload and geography. The model does not give specific recommendations for fire company allocation, but it does permit making a choice.

563. Hendrick TE, Plane DR, Monarchi DE, Tomasides C, Heiss FW and Walker WE
AN ANALYSIS OF THE DEPLOYMENT OF FIRE-FIGHTING RESOURCES IN DENVER, COLORADO. New York City Rand Inst; R-1566-3-HUD, 106 pages, 10 refs, May 1975

This report presents a description and the results of a study that was conducted to analyze the deployment of Denver's fire-fighting resources, and to develop improved deployment strategies for the Denver Fire Dept.

A management study of the Fire Dept was one of the provisions of the 1972-1973 contract with Denver's firefighters. Among the objectives of the study that resulted were: 1) to assess the current level of fire protection being supplied by the Fire Dept; and 2) to develop alternative fire station configurations that would provide approximately the same level of fire protection at a lower cost.

The study was performed in three stages (the results of each stage are presented in this report):

1) The relationship between response time and travel distance for responses to fire alarms in various regions of the city was determined.

2) An analysis of the deployment of fire companies was made using static models. This analysis assumed that every company is always available to respond to an incident from its quarters. It resulted in a set of alternative fire company configurations, which were analyzed in the third stage.

3) A simulation model of fire department operations was used to evaluate the set of alternative fire company configurations developed in stage 2. The primary purpose of using the simulation was to explore the effects of changing alarm rates upon the Dept's performance.

The study resulted in a long-term plan leading to a reduction of five fire companies. The plan specifies in detail the number and location of engine and ladder companies that Denver should have in order to maintain approximately the same level of fire protection. It also specifies a budgetary timetable for the changes that have to be made to the current configuration.

This report includes suggestions for other cities that might want to perform a similar study. (Author's Abstract)

564. Rider KL
A PARAMETRIC MODEL FOR THE ALLOCATION OF FIRE COMPANIES. New York City Rand Inst; R-1615-NYC-HUD, 19 pages, Apr 1975

This report describes an allocation method that avoids the difficulty of predetermining a specific criterion. Instead the method allows the decision-maker to enumerate a complete range of criteria by varying a trade-off parameter. In practice, it will often be the case that all but a small subset of these criteria will result in allocations with consequences that are unacceptable to fire department management.

The allocation model developed in this report provides an explicit trade-off parameter. The model uses travel time as a measure of system performance and generates allocations satisfying criteria ranging from the minimization of city-wide travel time to the equalization of average regional travel times as the trade-off parameter varies. While neither of these two criteria will necessarily produce satisfactory deployment policies, it may be expected that some policy between these two extremes will be reasonable. The Parametric Allocation Model therefore uses an objective function that encompasses, by the change of a single parameter, both of these criteria and all intermediate criteria. (Author's Abstract)

565. Walker WE
FIREHOUSE SITE EVALUATION MODEL: EXECUTIVE SUMMARY. New York City Rand Inst; R-1618-1-HUD, 41 pages, 10 refs, Jun 1975

This report provides a nontechnical overview of the Firehouse Site Evaluation Model (or "siting model"). It is designed to help local government officials and fire department administrators understand what the model is, when it should be used, how it works, what output information it provides, and what data, computer, and manpower resources are needed to use it. The siting model is one of several models developed by the New York City-Rand Inst to assist fire departments in solving the general problem of firehouse location. A description is given of the circumstances in which the use of each model is most appropriate.

The siting model provides a way to estimate the fire protection levels that would result from implementation of any given arrangement of fire companies. Fire protection is measured by average travel times and travel distances to all fires, travel times and distances to specific locations, and fire company workloads. By comparing the fire protection levels resulting from one arrangement to those resulting from others, rational decisions can be made about the deployment of a city's fire companies. (Author's Abstract)

566. Dormont P, Hausner J and Walker WE
FIREHOUSE SITE EVALUATION MODEL: DESCRIPTION AND USER'S MANUAL. New York City Rand Inst; R-1618-2-HUD, 183 pages, 11 refs, Jun 1975

This report describes a computer-based model, called the Firehouse Site Evaluation Model (or "siting model"), that can be used to evaluate alternative configurations of fire-fighting companies. The siting model provides a way to estimate the fire protection levels, measured in terms of travel times, travel distances, and company workloads, that would result from implementation of any given arrangement of fire companies. By comparing the fire protection levels resulting from one arrangement with those resulting from others, rational decisions can be made about the deployment of a city's fire companies.

The report is organized so that persons with different interests in the siting model can read the appropriate sections without having to read the entire report. The earlier sections are designed to be read by fire department planners and systems analysts. They provide information about how and when to use the model, the model's assumptions, and the input to and output from the model. An illustration of how the model was used to analyze fire company deployment in Trenton, New Jersey is also included. The later sections of the report are designed for the data processing personnel who will be installing and maintaining the siting model. They include a program listing, a description of the input data, sample printouts, and detailed instructions for installing the model. (Author's Abstract)

567. Kolesar P
A MODEL FOR PREDICTING AVERAGE FIRE COMPANY TRAVEL TIMES. New York City Rand Inst; R-1624-NYC, 19 pages, Jun 1975

In this Report we derive and test a fundamental model relating the average fire company travel time in a region to the area of the region covered, the number of fire companies stationed there, the rate at which alarms are received, the expected total service time per alarm, and some speed parameters. The model is one of several developed by The New York City-Rand Inst to analyze fire company deployment problems in New York City and has been applied there extensively. Recent changes in the number and location of fire companies in New York City were based partially on this analysis. (Author's Abstract)

568. Shanesy C
AN ON-LINE PROGRAM FOR RELOCATING FIREFIGHTING RESOURCES. New York City Rand Inst; R-1506-NYC, 191 pages, Jun 1975

This report describes a computer program that allows a fire dispatcher to monitor fire protection in his jurisdiction on a real-time basis. Based on equipment status entered by the dispatcher, the program informs him when coverage in some area is unsatisfactory and how to move equipment to correct the situation. This Report contains complete information for operating the program and extensive examples of its use based on a sample data base drawn from the Borough of the Bronx in New York City.

The Report also includes 1) instructions for preparing the data required to use the program in any geographic area, 2) a description of the logical flow of the program, 3) definitions of variables used in the program, 4) program modifications, and 5) program listings. (Author's Abstract)

569. Walker WE, Singleton DW and Smith BA
AN ANALYSIS OF THE DEPLOYMENT OF FIRE-FIGHTING RESOURCES IN WILMINGTON, DELAWARE. New York City Rand Inst; R-1566-5-HUD, 89 pages, Jul 1975
Availability: NTIS PB-250 465/2GA

The document is one of a series of case studies documenting deployment analyses of fire, police, and ambulance services in several American cities. It presents a description and the results of a study that was conducted to analyze the deployment of Wilmington's fire companies. The deployment analysis focused on two main issues: 1) how many engine companies should be deployed, and 2) given a certain number of engine and ladder companies, where should they be located. The project is described as a systems analysys case study, from problem definition through data gathering, analysis of alternative deployment policies, and derivation of final results. As a result of the study, one of the original nine companies was eliminated with no lay-offs and no reduction in fire protection, yielding an annual saving of $240,000. Plans were also developed for the phased construction of six new firehouses to replace six existing firehouses over a four year period. (Author)

570. Rider KL
A PARAMETRIC MODEL FOR THE ALLOCATION OF FIRE COMPANIES: EXECUTIVE SUMMARY. New York City Rand Inst; R-1646-1-HUD, 27 pages, Aug 1975
Availability: NTIS PB-250 443/9GA

A nontechnical overview is made of the allocation model for determining how to allocate firefighting resources to various regions of a city. The report is designed to help city administrators and fire department managers understand when the model should be used, how it works, what information it supplies, and what data and resources are needed to employ it. The Parametric Allocation Model provides a user with a general picture of the number of fire companies to be assigned to different regions of the city. It is inexpensive to use, and requires very little data, but it cannot be used to evaluate specific locations for the companies in detail. Its primary purpose is to assist in the initial steps of a fire station location study. (Author)

571. Ignall EJ and Urbach R
THE RELATIONSHIP BETWEEN FIRE-FIGHTING UNIT AVAILABILITY AND THE NUMBER OF UNITS DISPATCHED. Rand Corp, Santa Monica, CA; P-5420, 10 pages, May 1975
Availability: NTIS AD-A022 151/5GA

An important characteristic of a dispatching policy is the number of units sent to an incoming alarm. A common dispatching policy when alarm assignment cards (running cards) are used often sends whichever units are available from a particular group of units. Under this kind of policy, on the average, fewer units will be sent to an alarm in a busy part of the city than to one in a region with a low alarm rate. This is a reflection of the reduced unit availability in the busy region. In this paper, a simple quantitative relationship between average availability and average number of units sent is documented. (Author)

572. Rider KL
A PARAMETRIC MODEL FOR THE ALLOCATION OF FIRE COMPANIES: USER'S MANUAL. New York City Rand Inst; R-1646-2-HUD, 40 pages, Aug 1975
Availability: NTIS PB-250 444/7GA

The report is intended to provide systems analysts and data processing personnel with a user's manual for a computer program for locating fire houses. The allocation model can be used to generate and evaluate allocations of fire companies to regions of a city. The program operates in an interactive environment on a time-shared computer system. It has been used to analyze the deployment of fire companies in several cities, including Yonkers, New York; Wilmington, Delaware; and Jersey City, New Jersey. (Author)

9. PLANNING
b. Logistics

573. Rider KL, Hausner J, Shortell R, Bligh J and Candiloro T
AN ANALYSIS OF THE DEPLOYMENT OF FIREFIGHTING RESOURCES IN JERSEY CITY, NEW JERSEY. New York City Rand Inst; R-1566-4-HUD, 112 pages, Aug 1975
Availability: NTIS PB-250 464/5GA

The document is one of a series of case studies documenting deployment analyses of police, fire, and ambulance services in several American cities. It presents a description and the results of a study that was conducted to analyze the deployment of Jersey City's fire companies. Among the objectives of the study were: 1) to transfer to the city a knowledge of systems analysis, and 2) to use that methodology to develop a ten-year plan for the deployment of the city's firefighting resources. The analysis focused on the number, location, and manning of the city's fire companies; the type of vehicles that should be used; and the appropriate initial-dispatch policy. Several deployment options of similar cost were developed and evaluated. A complete description of the deployment analysis methodology is presented. (Author)

574. Hausner J
DETERMINING THE TRAVEL CHARACTERISTICS OF EMERGENCY SERVICE VEHICLES. New York City Rand Inst; R-1687-HUD, 75 pages, Apr 1975
Availability: NTIS PB-250 460/3GA

The report describes the mechanics of a data-gathering experiment and a computer program that can be used to analyze the experimental results. The experiment is designed to gather data to determine the relationship of travel time and travel speed to travel distance and time of day for emergency service vehicles responding to calls for service within a municipality. The resulting empirical travel characteristics are important input parameters for many mathematical models that can be used to study the deployment problems of municipal emergency service systems. The latter part of the report serves as a user's manual for the program, and includes a program listing, a description of the input data, a detailed explanation of the output, and a sample printout. (Author)

c. OPERATIONS ANALYSIS

575. Chaiken JM
HYPERCUBE QUEUING MODEL: EXECUTIVE SUMMARY. New York City Rand Inst; R-1688-1-HUD, 24 pages, Jul 1975
Availability: NTIS PB-250 440/5GA

The report describes in non-technical terms a computer program called the Hypercube Queuing Model. The report is designed to help emergency service agency administrators and other local government officials understand how the model can be used to design response districts for ambulances, police patrol cars, and firefighting units. It discusses when to use the model, how to use it, how it works, and what resources are needed to install it and use it. More detailed information is available in R-1688/2-HUD, Hypercube Queuing Model: User's Manual 1975 and R-1688/3-HUD Hypercube Queuing Model: Program Description, 1975. (Author)

576. Larson RC
HYPERCUBE QUEUING MODEL: USER'S MANUAL. New York City Rand Inst; R-1688-2-HUD, 108 pages, Jul 1975
Availability: NTIS PB-250 441/3GA

The Hypercube Queuing Model is a computer program that calculates selected performance measures of emergency service systems (police, fire and medical). It is especially useful for assisting police and emergency medical agencies in designing response districts for their mobile vehicles. This report is a manual for users of the model. It describes and gives examples of applications, describes the procedures to operate the computer program once it has been installed in the user's computer system, and discusses the output reports, the input data, and the costs of operation. A companion report 'Hypercube Queuing Model: Program Description,' R-1688/3-HUD, gives a listing of the computer program and provides information for programmers who wish to install the program. The theoretical development of the model is given in R-1238-HUD and R-1493-HUD. (Author)

577. Larson RC
HYPERCUBE QUEUING MODEL: PROGRAM DESCRIPTION. New York City Rand Inst; R-1688-3-HUD, 61 pages, Jul 1975
Availability: NTIS PB-250 439/7GA

The Hypercube Queuing Model is a computer program that calculates selected performance measures of emergency service systems (police, fire and medical). It is especially useful for assisting police and emergency medical agencies in designing response districts for their mobile vehicles. This report provides a listing of the computer program and is published to assist data processing personnel in modifying the program and installing it. A nontechnial introduction to the model is provided in R-1688/1-HUD, and a user's manual is contained in R-1688/2-HUD. Theoretical development of the model is contained in R-1238-HUD and R-1493-HUD. (Author)

10. HUMAN BEHAVIOR, SOCIAL AND MEDICAL PROBLEMS

[For more complete coverage of the behavioral and medical literature see: Psychology Abstracts and Index Medicus.]

a. ARSON

578. Bates EB
ELEMENTS OF FIRE AND ARSON INVESTIGATION
Davis Publ Co, Inc, Santa Cruz, Calif; 167 pages, 1975

The author of this book is Sheriff-Coroner of Madera County, California, and has been a Special Agent in the Fraud and Arson Bureau of the National Board of Fire Underwriters. The book is written in relatively nontechnical language, and is directed to those who from time to time are charged with responsibility of investigating fires. This would include personnel with volunteer fire departments as well as paid departments. It is designed to give the investigator a systematic and approved method of gaining basic knowledge about the nature of fire, the determination of the point of origin of the fire, the development of evidence, incendiary devices, interview techniques, motives, and court testimony. In the back of the book there are two typical fires and arson investigation quizzes for the student to use as a study guide.

579. Kerr JW
INCENDIARISM: AN OVERVIEW AND AN APPRAISAL
Arson and Incendiarism Conf; 1975, Jul 29-30, Washington, DC
Availability: NTIS AD-A018 726/OGA

This report summarizes the conclusions reached by members of the Committee on Fire Res on the Commission on Sociotechnical Systems of the Nat Res Council and by experts in the field of arson and incendiarism who were in attendance at a Conf on Arson and Incendiarism held at the Nat Acad of Sciences on July 29-30, 1975. It was the firm conclusion of the Committee on Fire Res that a symposium on incendiarism should be held within the next 10 to 12 months at the Nat Acad of Sciences. The symposium should 1) review the state of the art of detection, investigation, and prevention of incendiarism; 2) stress the pursuit of knowledge in areas singled out in this report as deficient; 3) review action programs in related areas; and 4) emphasize behavioral interfaces with other segments of the problem. 15 pages (Author's Abstract)

580. Maguire HM
JOINT EFFORT FIGHTS ARSON
Fire Chief, 20(6):44-45, 1976

An eight-agency Seattle Metro Task Force on Arson has been constituted from police and other public and private agencies to insure better protection against arson fires. Under the new arson squad plan, a joint fire and police investigative unit will handle arson investigation. A three-phase training program has been devised: the first phase is a basic law enforcement course, phase two is the same as the police detective course, and phase three will offer courses in advanced arson investigation techniques.

In the future the task force will be concerned with providing a metropolitan orientation for the professional investigation of fires in other jurisdictions. Plans call for the development of an information program to aid in prediction, a county-wide system for the collection and distribution of data on arson, and working with the results of the National Fire Prevention and Control Administration program pursuant to the Fire Safety Act of 1974.

581. Broodo A, Gilmore J and Armstrong A
DID ARSON CAUSE THAT PLANT FIRE?
Hydrocarbon Process, 55(2):7-8, 70-71, 74, 75, 79, 1976

Since investigation of a fire's cause in a hydrocarbon processing plant is more complex than for most other types of fires, the present high proportion of arson fires should be kept in mind. Certain routines, discussed in this article, should be followed from the outset in looking into fires in such plants. 3 figs.

582. Moll KD
ARSON, VANDALISM AND VIOLENCE: LAW ENFORCEMENT PROBLEMS AFFECTING FIRE DEPARTMENTS. US Dept of Justice, Nat Inst of Law Enforcement and Criminal Justice, 173 pages, 80 refs, Mar 1974

A study of violence problems involves a cross section of nearly all the social influences affecting fire and police departments today. The data make clear, for example, that while group violence such as civil disorders, open harassment, and organized bombings have reached their peaks, the more individual, surreptitious types of behavior such as arson and false alarms are still rising. The central cities remain the most intense trouble spots, but rates are generally rising more rapidly in outlying suburbs.

Except for arson, violence behavior is not an unmanageable burden to fire departments at the present time. When measured in terms of property losses (i.e. the percentage of total building fire losses due to violence behavior), the burden is greater than when measured in terms of human losses (the percentage of total fire department injuries caused by violence behavior), but neither measure is very large. This study estimates that the combined losses of public disorders and harassment were only about five percent of all building fire losses in 1967, and that such losses have declined substantially since. The combined fire and nonfire costs of bomb incidents are approximately one percent of all building fire losses. False alarm costs are on the order of five percent of the costs of building fires, and could be substantially reduced if the necessary policy decisions and equipment investments were made. The costs of bomb threats were not calculated, but since their frequency is only one-tenth to one-fiftieth as great as that of false alarms, their costs are unlikely to be as great as one percent of all building fire costs.

Arson losses, in contrast, account for at least ten percent, and possibly 30 percent or more, of all building fire losses - greater than all the other costs of violence combined. Furthermore, arson rates are rising faster than other types of fires, and faster even than most types of crime. Current enforcement efforts are severely inadequate in comparison with enforcement efforts for other types of crime.

The frequency of violence behavior is quite volatile and variable from urban to suburban areas, indicating that the major factors in violence trends are social and demographic in nature, rather than the result of public safety policies. As such, they can flare up to serious levels at unpredictable times and place. Several policies - some technical, some operational and some social - do have noticeable influences on violence behavior. Over time, successful implementation of these policies should aid greatly in making the violence problems studied more manageable. (Author's Abstract)

b. COMBUSTION TOXICOLOGY

583. Stewart RD, Stewart RS, Stamm W and Seelen RP
RAPID ESTIMATION OF CARBOXYHEMOGLOBIN LEVEL IN FIRE FIGHTERS
J Am Med Assoc, 235(4):390-392, 1976

The analysis of expired breath with a portable electrochemical cell after carbon monoxide exposure provides a practical field method for the rapid estimation of carboxyhemoglobin. A fire fighter can collect and analyze his own breath sample for CO, an operation that requires 1-1/2 minutes. This simple technique has the accuracy necessary to determine compliance with the regulations governing occupational exposure to CO. 2 figs, 1 table, 19 refs. (Author)

584. Mollins RB and Park S
RESPIRATORY COMPLICATIONS OF SMOKE INHALATION IN VICTIMS OF FIRES
J_Pediatr, 87(1):1-7, 1975

Respiratory complications of smoke inhalation are responsible for much of the morbidity and mortality associated with fires. An increase in morbidity and mortality rates out of proportion to what one would have predicted from the degree of surface burn can be directly related to smoke inhalation and respiratory tract injury. Furthermore, severe injury to the respiratory tract can occur even in the absence of surface burns.

Patients trapped in confined spaces are more likely to sustain serious injury to the lung from the inhalation of the products of incomplete combustion generated during fires. For this reason, small children and the aged are at increased risk. In addition to thermal injury and the toxic effects of noxious gases on the respiratory mucosa, severe asphyxia with brain injury may occur, especially if there is a significant amount of carbon monoxide poisoning.

The present review focuses on the respiratory complications of smoke inhalation. No attempt has been made to summarize all of the earlier literature since an extensive review has appeared recently. Rather, attention is concentrated on our current understanding of the pathogenesis and current approaches to clinical management are evaluated. 36 refs. (Author)

585. Jellinek HHG and Takada K
TOXIC GAS EVOLUTION FROM POLYMERS: EVOLUTION OF HYDROGEN CYANIDE FROM LINEAR POLYURETHANE
J_Polym__Sci,_Polym_Chem_Ed, 13(12):2709-2723, 1975

HCN evolution from linear polyurethane has been studied over a range of temperatures from 261 to 480°C as function of exposure time, oxygen pressure, film thickness, and chain length. IR spectra have also been measured as function of exposure time. In addition, gas evolution during thermal degradation in vacuo has been investigated in a quartz spoon reaction vessel. Rate constants and energies of activation have been evaluated for all reactions. Gas evolution and adsorption are diffusion-controlled during thermal and thermal-oxidative degradation up to at least 330°C. Thermal degradation consists essentially of a reversal of the polycondensation process. The thermal-oxidative degradation is a complicated reaction involving chain scission, crosslinking, carbonization, and gas evolution. HCN evolution, although appreciable, is only a minor side reaction of the total oxidation process. A tentative mechanism for HCN evolution has been proposed. 14 figs, 3 tables, 17 refs. (Author)

586. Morikawa T
EVOLUTION OF IRRITANT MATERIALS FROM SMOLDERING COMBUSTION
Rep_Fire_Res_Inst_Japan, (41):62-75, 1976
English(Japanese summary)

The evolution of irritants, acrolein, formaldehyde and volatile fatty acids were determined when various materials were heated in a current of air or nitrogen. Polyethylene, polypropylene, vinylon and cellulosic materials produced relatively large quantities of irritants. The evolution of acrolein and formaldehyde was much more dangerous than that of volatile fatty acids in terms of toxicity. The maximum evolution of acrolein and formaldehyde in practical smoldering combustion experiments was 1/2 - 1/3 of that in the temperature-controlled experiments. Estimated concentrations of both acrolein and formaldehyde indicate that a considerably hazardous condition could be reached even by smoldering fires. 15 figs, 3 tables, 13 refs. (Author)

587. Rieber M
WHERE ARE THE DANGERS IN FIRES - FIRE GASES AND THEIR EFFECTS
Zentralbl___Arbeitsmed___Arbeitsschutz, 25(5):133-139, 1975 (German)

When organic materials burn, gases are generated which cannot be perceived by the senses, but which alter the environmental conditions hazardously for man. Fire gases and their effects are discussed using the "fire triangle" to illustrate the generation of such gases. Physiological effects of fire gases are summarized in a table, as are the ignition temperatures of various materials, the decomposition temperatures of various polymers, and smoke densities. 5 tables, 6 refs.

588. Dillon JC
SMOKE - THE SILENT KILLER
Fire_Command, 43(4):20-23, 1976

In order to alert civilians and firefighters to preventive measures to be taken to eliminate the fire and smoke danger, the three different problems lumped under the heading of "smoke inhalation" are discussed: hypoxia, or inadequate oxygen; systemic poisons, the three common ones being carbon monoxide, hydrogen sulfide, and hydrogen cyanide; and local irritants that attack the broncho-pulmonary tree. A chart of the irritants released by burning the common materials wood, wool, rubber and plastics is given. Proper fire prevention, early detection systems, and common sense on the fireground can reduce the number of debilitating and deadly incidents of smoke inhalation. 1 fig.

589. Vasil'ev GA, Ilichkin VS and Romanov EI
VERIFICATION OF SOME PRINCIPLES FOR EVALUATING THE TOXICITY OF VOLATILE PRODUCTS OF THE COMBUSTION OF POLYMERIC MATERIALS
Sb_Tr_VNII_protivopozhar_oborony, (5):65-74, 1974 (Russian)

590. Waritz RS
AN INDUSTRIAL APPROACH TO EVALUATION OF PYROLYSIS AND COMBUSTION HAZARDS
Environ_Health_Perspect, 11:197-202, 1975

In addition to the usual toxicology studies necessary for the safe manufacture and use of polymers at room temperature, special studies are needed for polymers which will be used at elevated temperatures. This paper discusses various areas to be investigated and principles for deciding on test materials, tests, and test conditions, polytetrafluoroethylene (PTFE) and fluorinated polyethylene propylene pyrolysis studies being used as an illustrative case history. Some limitations of animal testing also are mentioned. A toxicological spectrum relating toxicological determiants to PTFE temperature is developed.

591. Zikria BA, Budd DC, Floch F and Ferrer JM
WHAT IS CLINICAL SMOKE POISONING?
Ann_Surg, 181(2):151-6, 1975

In this 13 year study, 51 patients were admitted with the primary diagnosis of "smoke poisoning", carbon monoxide (CO) poisoning or respiratory burns, 40 patients (78 percent) had diagnosis of smoke poisoning with minor or no skin burns. The study indicated that clinical diagnosis of CO poisoning cannot be made reliably without carboxyhemoglobin (COHb) determination and that smoke poisoning patients often had CO poisoning. 17 of 19 smoke poisoning patients (89 percent) had CO poisoning above COHb levels of 15 percent saturation. Carbon monoxide was successfully removed from the blood by improving alveolar ventilation and oxygen concentration. However, there were 2 smoke poisoning deaths as the result of gaseous chemical injury. There was a correlation coefficient of 0.87 between initial COHb levels and patients hospital days primarily determined by patients' pulmonary complications. Since CO is non irritating, COHb levels may be used as an additional indicator of suspected pulmonary injury by noxious combustion gases.

592. Einhorn IN
PHYSIOLOGICAL AND TOXICOLOGICAL ASPECTS OF SMOKE PRODUCED DURING THE COMBUSTION OF POLYMERIC MATERIALS
Environ_Health_Perspect, 11:163-89, 1975

Normally one expects that flame contact is the major cause of injury and death during fires. Analysis of the factors involved in numerous fires has revealed that most deaths were not due to flame contact, but were a consequence of the production of carbon monoxide, nitrogen oxides, and other combustion products such as aldehydes, low molecular weight alcohols, hydrogen cyanide, and other noxious species. The major emphasis within the scope of this paper relates to the physiological and toxicological aspects of smoke produced during the combustion of materials. Special emphasis is directed toward laboratory procedures which have been developed to determine the qualitative and quantitative analysis of smoke, factors pertaining to smoke development, and to measure the response of laboratory animals exposed to smoke. The effects that fire retardants, incorporated into polymeric materials as a means of improving flammability characteristics, may have on smoke development, the mechanism of polymer degradation, and on the survival response of laboratory animals are also considered.

593. Skornik WA, Robinson RS and Dressler DP
TOXICITY OF THERMAL DECOMPOSITION PRODUCTS OF VARIOUS PAINTS
J_Combust_Toxicol, 3(1):71-83, 1976

Unrestrained and unanesthetized rats were exposed to the smoke produced by the smoldering of four types of paint: vinyl acrylic latex, polyurethane, oil, and flat enamel alkyd. These paints were applied in two or four coats thickness to standard gypsum wall board which was also smoldered as a control. The exposure was for 15 minutes at ambient temperatures. Deaths only occurred following exposures to the alkyd base paint. The mortality was 20.8 percent with two coats, an average day of death of six days with a range from 0-18 days; with four coats, the mortality was 21.9 percent, with an average day of death of 4.2 days and a range of 1-16 days. Studies to determine the time of useful function were carried out with alkyd base paint and showed that the animals were incapable of performing coordinated movement at 10.6 minutes. This was not significantly different from that found following exposure to gypsum wall board alone. However, with four coats of paint, the time of useful function was reduced to 6.3 minutes. Preliminary pathologic studies of the liver, lung, and kidney revealed no obvious cause of these late deaths following exposure. Extrapolation of these results revealed that smoldering of as little as 40 percent of an 8 x 12 foot alkyd base painted surface could result in significant mortality, and indicates that further investigation is indicated to identify the particular toxic agent and the mechanism of death. 3 figs, 4 tables, 7 refs.

594. Birky MM
PHILOSOPHY OF TESTING FOR ASSESSMENT OF TOXICOLOGICAL ASPECTS OF FIRE EXPOSURE
J_Combust_Toxicol, 3(1):5-23, 1976

An assessment of the relative toxicity of combustion products is an extremely complex problem. It can not be done with a chemical analysis of the pyrolysis or combustion products no matter how appealing this may be. The effects of these products on a living organism must be determined. Three major methodologies are required for this assessment, each methodology containing a number of parameters that must be specific. These methodologies are:

1. method of product generation,
2. method of animal exposure, and
3. method of analysis of toxicants and correlation with toxicological results.

The overall toxicological evaluation can be aided by comparing the toxicity of the combustion products with carbon monoxide. This requires a carbon monoxide analysis in the fire atmosphere and a carboxyhemoglobin analysis in the experimental animal.

It should be obvious from the above discussion that the problem is an interdisciplinary one and will require the combined efforts of the toxicologist, analytical chemist and combustion scientist. 2 tables, 42 refs. (Author's Abstract)

595. Voorhees KJ, Einhorn IN, Hileman FD and Wojcik LH
THE IDENTIFICATION OF A HIGHLY TOXIC BICYCLOPHOSPHATE IN THE COMBUSTION PRODUCTS OF A FIRE-RETARDED URETHANE FOAM
J_Polym__Sci:_Polym_Lett_Ed, 13(5):293-7, 1975

An extremely toxic material, 4-ethyl-1-phospha-2,6,7-trioxabicyclo[2,2,2]octane-1-oxide, was identified in the combustion products from a urethane foam formulated from a propoxylated trimethylolpropane polyol PAPI and a phosphorus fire retardant. (Author's Abstract)

596. Dyer RF and Esch VH
POLYVINYL CHLORIDE TOXICITY IN FIRES. HYDROGEN CHLORIDE TOXICITY IN FIRE FIGHTERS
J_Am_Med_Assoc, 235(4):393-7, 1976

Polyvinylchloride, of all the plastic polymers, has been implicated primarily in causing the most serious problem in firefighting today because it releases hydrogen chloride gas when burning. One hundred seventy firefighters who experienced symptoms from its toxicity have been studied from 1970 to 1975. One died. 2 figs, 10 refs. (Author's Abstract)

597. Einhorn IN
PHYSIOLOGICAL AND TOXICOLOGICAL ASPECTS OF SMOKE PRODUCED DURING THE COMBUSTION OF POLYMERIC MATERIALS
Environ_Health_Perspect, 11:163-189, 1975

The major emphasis within the scope of

this paper relates to the physiological and toxicological aspects of smoke produced during the combustion of materials. Special emphasis is directed toward laboratory procedures which have been developed to determine the qualitative and quantitative analysis of smoke, factors pertaining to smoke development, and to measure the response of laboratory animals exposed to smoke. The effects that fire retardants, incorporated into polymeric materials as a means of improving flammability characteristics, may have on smoke development, the mechanism of polymer degradation, and on the survival of laboratory animals are also considered. 12 figs, 18 tables, 65 refs. (Author's Abstract)

598. Petajan JH, Voorhees KJ, Packham SC, Baldwin RC, Einhorn IN, Grunnet ML, Dinger BG and Birky MM
EXTREME TOXICITY FROM COMBUSTION PRODUCTS OF A FIRE-RETARDED POLYURETHANE FOAM
Science, 187(4178):742-4, 28 Feb 1975

The products from nonflaming combustion of wood and trimethylolpropane-based rigid urethane foams that was not fire-retarded produced elevated carboxyhemoglobin levels but no abnormal neurological effects. However, when this type of foam contained a reactive phosphate fire retardant, the combustion products caused grand mal seizures and death in rats. The toxic combustion product responsible for the seizures has been identified as 4-ethyl-1-phospha-2,6,7-trioxabicyclo[2,2,2]octane-1-oxide. (Author's Abstract)

599. Hilado CJ
RELATIVE TOXICITY OF PYROLYSIS PRODUCTS OF SOME FOAM FABRICS
J Combust Toxicol, 3(1):32-60, 1976

There is a need for screening test methodology to compare the relative toxicity of the products of pyrolysis and combustion from the wide variety of materials used in aircraft, buildings, consumer products, and other applications. The apparatus should be low in cost and in investment; procedures for operation should be simple and understandable to the user with little specialized training in fire toxicity; and finally the test results should be reproducible and reliable in day-to-day use.

A limited number of foams and fabrics was evaluated in the course of developing test procedures for determining the relative toxicity of materials. The principal variable studied, heating rate, did not affect the relative ranking of the materials tested. Two pyrolysis test procedures using the same basic approach but employing different sample weights, chamber volumes, laboratory animals, heating rates, and upper temperature limits, resulted in identical rankings of relative toxicity.

The data obtained show that modification of conventional flexible polyurethane foams with flame retardants to comply with California upholstered furniture flammability regulations seems to consistently reduce toxicity under pyrolysis conditions. 2 figs, 12 tables, 66 refs. (Author's Abstract)

600. Spurgeon JC
A PRELIMINARY COMPARISON OF LABORATORY METHODS FOR ASSIGNING A RELATIVE TOXICITY RANKING TO AIRCRAFT INTERIOR MATERIALS. FINAL REPORT, JUL-OCT 1974. Nat Aviation Facilities Experim Center; FAA NA-74-57, FAA RD-75-37, 40 pages, Oct 1975
Availability: NTIS AD-A018 148/7

Thirteen aircraft interior materials were tested in order to compare the National Bureau of Standards (NBS) smoke chamber and the microcombustion tube furnace. The microcombustion tube furnace ranked nitrogen- and chloride-containing test materials of known composition according to the expected order based upon HCN and HCl concentrations. The nitrogen-containing test materials were not ranked in the expected order in the NBS smoke chamber. Several methods of sampling combustion gases from the NBS smoke chamber have been investigated in an attempt to maximize sample recovery. In general, syringe sampling resulted in the best sample recoveries. Animal toxicity tests were conducted for nine aircraft interior materials using Sprague-Dawley rats by exposing the test animals to the combustion products. A preliminary correlation of animal toxicity data with measured gas concentrations indicates that a possible relationship exists between times-to-incapacitation and hydrogen cyanide concentrations produced by the test materials. (Author)

601. Paabo M, Pitt B, Birky MM, Coats AW and Alderson SE
MEASUREMENTS AND OBSERVATIONS OF THE TOXICOLOGICAL HAZARD OF FIRE IN A METRORAIL INTERIOR MOCK-UP. Nat Bureau of

Standards, Inst for Applied Technol; NBSIR 75-966, 20 pages, Feb 1976
Availability: NTIS PB-250 768/9GA

Oxygen depletion, carbon monoxide, carbon dioxide, hydrogen chloride and hydrogen cyanide were selected for measurement and identification in Metrorail fire tests. Male rats exposed to the combustion products were examined for changes in blood chemistry, gross pathology and loss of function. Hydrogen cyanide and carbon monoxide levels in blood were elevated and functional changes were noted. (Author)

602. VanStee EW
A REVIEW OF THE TOXICOLOGY OF HALOGENATED FIRE EXTINGUISHING AGENTS. Aerospace Med Res Labs; AMRL TR-74-143, 89 pages, Nov 1974
Availability: NTIS AD-A011 538

Bromotrifluoromethane (Halon 1301), bromochlorodifluoromethane (Halon 1211), and chlorobromomethane (Halon 1011) were evaluated for toxicity and toxic hazards. The most important toxicological effects of these compounds are on the central nervous and cardiovascular systems. The neurological effects are manifested as alterations of perception and a reduction in reaction time and the ability to concentrate on complex intellectual tasks. The cardiovascular effects are manifested as changes in cardiovascular dynamics and the electrical activity of the heart. Clinically important central nervous system effects generally appear at lower levels of exposure than clinically important cardiovascular effects. Behavioral changes and performance decrements during exposure would undoubtedly have some effect on the interaction of the subject with his environment, and such consequences of exposure could be life-threatening.

603. VanStee EW, Harris AM, Horton ML and Back KC
TOXIC HAZARDS EVALUATION OF NEW AIR FORCE FIRE EXTINGUISHING AGENTS. Aerospace Med Res Labs; AMRL TR-74-125, Paper No. 12, 22 pages, Dec 1974
Availability: NTIS AD-A011 861

Major technical areas discussed include ecosystem modeling, water polution, water reuse, toxic hazards evaluation of fire extinguishants, environmental carcinogenesis, and cellular toxicology.

604. Petajan JH, Baldwin RC, Rose RF and Jeppsen RB
THE ASSESSMENT OF THE RELATIVE TOXICITY OF MATERIALS: CONCEPT OF A LIMITING TOXICANT; Paper No. 15
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: Nat Bureau of Standards

Intoxication syndromes produced on exposure to products of degradation of many materials in our environment constitute a serious hazard to human life. Such a great number of materials are involved that detailed study of each one is not possible. As a result of the fact that degradation products may vary with such conditions as heat flux, the physical configuration of the material, flaming or nonflaming modes of combustion, systems for conducting smoke, etc, procedures for analysis of the toxicological hazard for even a single material can be very complex and time-consuming. Because of these constraints, it seems reasonable to attempt to identify those materials which produce unusual or exceptional toxicity.

This paper describes recent work directed towards use of animals for assessing the limiting toxicant hazard present in combustion products of materials exposed to fire. (Author's Abstract)

c. EMERGENCY MEDICAL SERVICES AND FACILITIES

605. Miller RH and Cantrell JR
TEXTBOOK OF BASIC EMERGENCY MEDICINE
The C V Mosby Co, St. Louis, Mo; 233 pages, 1975

The inspiration for this book came from the development of the training program for the Seattle Fire Department's Emergency Paramedic Program, according to the principle authors. It is therefore directed primarily toward education of the emergency paramedic. This book is divided into two main sections: Emergencies involving the heart, and emergencies involving other body systems. An appendix offers Standards for cardiopulmonary resuscitation (CPR) and emergency cardiac care (ECC). In addition to the two authors, a number of other physicians have contributed material for the book.

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS
c. Emergency Medical Services and Facilities

606. Cervenak MM, Garavaglia MM and Fields LJ
PRINCIPLES OF EMERGENCY RESPIRATORY CARE
Glenn Educational Med Services, Inc, Sarasota, Fla; 246 pages, 1976

Respiratory system and cardiovascular anatomy and physiology information in the first two chapters provides a background for understanding the respiratory problems and techniques for overcoming them in the rest of the book.

Cardiopulmonary resuscitation and the maintenance of an airway are explained at length. Other chapters discuss the properties of gases, standards and specifications for oxygen equipment, and the administration of oxygen. Numerous drawings illustrate techniques and anatomical discussions. Photos are used where they are more effective. It is a book that should be of particular interest to the EMT or paramedic.

607. Folsom F
EXTRICATION AND CASUALTY HANDLING TECHNIQUES
J P Lippincott Co, Philadelphia, Pa; 150 pages, 1975

The author of this book is EMC Training Coordinator, Emergency Medical Services Program, State of Maine and Director, Maine Extrication and Casualty Handling Program. In the preface the author says that casualty handling and extrication are "the neglected children of emergency medical care." The list of main chapters in the book will give an idea of the scope of the book: the attendant and the emergency vehicle, examination of the victim, extrication straps and strapping, immobilization of spinal injuries, forcible entry and forcible extrication, extrication techniques, techniques for handling patients, disaster management, utilization of local resources, and conclusions.

608. Schorr M
ON THE USE OF BREATHING APPARATUS IN THE RESCUE SERVICE
Brandschutz, 30(1):6-8, 1976 (German)

By means of clinical investigations and tests an attempt was made to obtain information on the fitness and possibilities of using various breathing devices for the needs of the rescue service. The intention was to produce evidence as to the suitability of the SSA 2000 oxygen respirator by objective measurement results and complementary subjective evaluations on the part of four test subjects. The SSA 2000 was compared with the Travox and the DA 58/1600 compressed air respirator, all of which are being used primarily by technical aid units. The subjective and objective results are summarized in two tables. No striking, clinically relevant changes in the breathing and circulation functions of the four test subjects were found. The varying subjective evaluations cannot be assessed for statistical reasons. 2 tables.

609. Briesse GL
PRESCRIPTION FOR EMS TRAINING
Fire Command, 43(1):18-20, 1976

The executive director of the Florida Chapter of the American College of Emergency Physicians discusses the deficiencies in basic medical training of ambulance personnel and describes the ingredients necessary for an emergency medical training course. 2 figs.

610. Nailen RL
RESCUE SQUAD MONITORS PHYSICAL CONDITION OF MEN DURING FIRES IN MILWAUKEE
Fire Eng, 129(3):32-36, 1976

The Milwaukee Fire Department's two-man rescue company conducts on-the-scene checking of several vital signs (the carboxyhemoglobin level in the blood by an Ecolyzer, and, if high, the heart condition by electrocardiograph) and comparison with base data on the man under normal at-rest conditions and then deciding from that comparison whether he can tolerate further exposure. Either treatment is administered at the scene or, if response is unsatisfactory, additional treatment and closer observation away from the scene are advised. Screening forms are maintained for review by the assistant chief and entered as a statistic on a master chart. 3 figs.

611. Anon
BURN CARE FACILITIES IN SOUTHERN NEW JERSEY. Comprehensive Health Planning Agency of Southern New Jersey; HRP 0004532/8GA, 24 pages, Mar 1975
Availability: NTIS

The need for burn care centers in southern New Jersey, which at present has no such facilities, is described and guidelines are proposed for the development of such a facility. The current estimated need is placed at 17 burn center or burn unit beds with a capability of treating 306 individuals annually. Utilizing recommendations of the Inst for Burn Medicine of the Univ of Michigan, projections of future needs indicate that a total of 13 burn programs, three burn units, and one burn center would meet area requirements through 1980. Purposes and components of a burn care unit are listed, and an analysis is made of costs of burn care facilities. It is recommended that any new burn care centers or units be developed through conversion of current facilities rather than construction of new facilities; that the initial facilities developed consist of burn care units, one of which may later develop into a more sophisticated burn care center; third parties should provide financial support for burn care patients beyond the normal third-party coverage; and facilities which intend to engage in burn care services should consider provisions for rehabilitation services. Portions of this document are not fully legible. (Author's Abstract)

612. Anon
GUIDELINES FOR THE PLANNING AND DEVELOPMENT OF BURN CARE IN WESTERN PENNSYLVANIA. Comprehensive Health Planning Association of Western Pennsylvania, Regional Plan Development Committee; HRP 0003803/4GA, 19 pages, Dec 1974
Availability: NTIS

Qualitative and quantitative guidelines for planning and developing a community-oriented system of burn care are presented. A burn care center is defined, and criteria for patients to be transferred to such a center are set forth. Staffing of a burn center team consists of the following: chief of burn center (surgeon), one or more resident physicians, nursing supervisor and staff, clerical personnel, exclusive housekeeping staff, consultants from appropriate specialty services, occupational and physical therapists, psychiatrist or psychologist, nutritionist, and photographer. Facilities and equipment are described. Similar considerations are discussed for general hospitals providing specific burn care to patients not requiring treatment at a burn care center. Economic considerations are outlined. It is noted that establishment and operation of a burn center is extremely costly, both financially and in manpower hours required per patient. Estab of a community education program to decrease occurrence of burn injuries is encouraged; a formula for such a program is outlined. A formula for forecasting burn center bed needs by service area is given. A flowchart of the comprehensive health planning process and a bibliography are included. (Author's Abstract)

d. INJURIES AND FATALITIES

613. Clarke FB and Ottoson J
FIRE DEATH SCENARIOS AND FIRESAFETY PLANNING
Fire J, 70(3):20-22, 117-118, 1976

A fire loss ranking system is basic to any attempt to plan and evaluate firesafety programs. The scenario concept, in which a series of events leading up to a fire is described, has proved to be a useful tool. The purpose of the article is to introduce the scenario concept and to show how the available data, to be perfected as the nation's new fire data system matures, can be used to develop a quantitative ranking of scenarios for fire deaths. Until more complete data are available, an interim nonquantitative classification system, illustrated in a diagram, has been developed, based on four existing data systems. 1 fig, 2 tables.

614. Washburn AE
A DEADLY BUSINESS
Fire Command, 43(4):26-28, 1976

The author, a professional firefighter, presents information collected by the NFPA on 102 firefighters who died in the line of duty during 1975. The leading cause was heart attacks or heart-related problems. Mechanical injuries were responsible for 23 deaths, while 14 asphyxiation fatalities were reported. Other causes were flashover, gasoline tanker explosion, sawdust hopper explosion, drowning, electrocution, and homicide at the firehouse, apparently by an irate neighbor. 2 figs.

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS
d. Injuries and Fatalities

615. Halpin BM, Radford EP, Caplan Y and Fisher R
A FIRE FATALITY STUDY
Fire J, 69(3):11-3, 1975

Summary of the JHU/APL Fire Fatality Study through June 1974. All fire fatalities in the Maryland State that receive an autopsy are examined in detail for physical, physiological, and toxicological causes. The case load through June 1974 was 133 people in 105 fires. The vast majority of the fires were in residential dwellings. Smoking was found to be the main cause of fire, with alcohol as an added offender in all phases of the problem. Carbon monoxide was considered as the agent responsible in some manner for about 80% of the deaths. Synthetic materials were only implicated in approximately 5% of the cases. (Author's Abstract)

616. Marzetta LA
A THERMESTHESIOMETER - AN INSTRUMENT FOR BURN HAZARD MEASUREMENT
IEEE Trans Biomed Eng, BME21(5):425-7, Sep 1974
Availability: NBS COM 75-10608/9GA

Surface temperature measurement alone is insufficient to establish the hazard to the human of contact with a hot or cold object. A metal surface is more likely to cause thermal injury than a plastic surface at the same temperature. An instrument equipped with a measuring probe has been developed for indicating the temperature that would be experience if human contact were made with the hot surface in question. The correct value of interface contact temperature can be read for a selected contact time without knowing the composition or temperature of the heated material under test. (Author's Abstract)

617. Buchbinder LB
HUMAN BEHAVIOR PATTERNS VS INJURY SEVERITY FOR APPAREL FIRE VICTIMS
Fabric Flammability Information Council Meeting, 7th Annual, Proc; 1973, Dec 5, New York, NY, pages 236-253
Sponsor: The Cotton Foundation, Memphis, TN
Availability: Information Council Meeting, 1133 Avenue of the Americas, New York 10036, PB-246 730/6GA

This study is based on information from 1126 fire accident cases in the NBS computerized data base, FFACTS. The defensive actions taken by persons involved in apparel fires are described and the effect of these reactions on the severity of the resultant burn injuries is discussed. The relative frequency of reactions is observed with reference to age, sex, and the type of accident. The effectiveness of various reactions was analyzed considering both the extent of injury incurred and the number of additional reactions required to extinguish the fire. The victim's ability to recognize danger and take appropriate action was also related to the level of injury severity.

618. Balanoff T
FIRE FIGHTER MORTALITY REPORT. Internat Assoc of Firefighters; NBS GCR-76-60, 171 pages, Mar 1976

This 15-month study involved the investigation of 101 firefighters in-the-line of duty deaths. The breakdown of cause of death was: 45 heart attacks, 13 building collapses, 12 burns, 9 smoke inhalations, 6 apparatus accidents, 5 electrocutions, and 1 equipment failure. There tended to be a higher incidence of fatalities occurring in the Mid-Atlantic, East, and New England areas. The mean age of firefighter's fatality was 43.5 and the mean years of service was 15.8. Sixty percent of the fatalities occurred to men holding the rank of firefighter. The vast majority of firefighters who died in the line of duty worked either a split shift (10/14) or a 24-hour shift. There were 14 volunteer firefighter fatalities.

Summaries of every case are provided in one of three sections: Firefighters Killed While Fighting Fires, Firefighters Killed in Non-fire Situations, and Firefighters Killed by Heart Attack.

Firefighters Killed While Fighting Fires: Protective equipment, improper use, nonuse and/or insufficient equipment were a contributing factor in several of the smoke inhalation and burn cases. In 9 of the 41 cases in this section there was a relationship between the fatality and the individual's firefighting experience. There was found to be a relationship between officer leadership on the fireground in a number of the fatalities. A shortage of manpower on the ground contributed to six fatalities. Other contributing factors discussed in this section are: communications, late notification, civilian responsibilities, fire prevention, pre-fire planning, and arson.

Firefighters Killed in Non-Firefighting Situations: Equipment, type of protective clothing, apparatus and tools were a contributing factor in the vast majority of the fifteen cases of this section. In several cases the victim firefighters did not have the experience or proper training in which to conduct the duties required of them.

Firefighters Killed by Heart Attack: The mean age of the firefighter heart attack victim was 51.3 and the mean years of service was 22. In general, the victims were slightly overweight and 60 per cent of them smoked cigarettes regularly. There were three specific aspects of firefighting that contributed to the development of heart disease: exposure to smoke/toxic fume inhalation, stress, and over-exertion. In over one-third of the cases, firefighters experienced symptoms of heart trouble before the actual attack. In 7 of the 45 cases firefighters had suffered heart attacks previous to the fatal one. There were several procedural problems after the heart attack occurred. Most serious of these were late ambulance responses, lack of proper equipment, and trained personnel (EMTs) on the fireground to perform emergency medical treatment. (Author's Abstract)

619. Bercaw JR, Jordan KG and Moss AZ
ESTIMATING INJURY FROM BURNING GARMENTS AND DEVELOPMENT OF CONCEPTS FOR FLAMMABILITY TESTS; Paper No. 4
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

The basic objective of product safety tests and standards is to protect the public from the unreasonable risk of serious injury, death, or property loss. In addition, to protect the public from undue burden, such standards should be addressed to those areas where:

- the need is the greatest
- the hazard can be defined
- a relevant test method can be designed to protect against such hazard,
- reasonable cost-benefit can be predicted.

These represent many of the points stated in the Flammable Fabrics Act and voiced by the Consumer Product Safety Commission.

This paper reviews recent studies related to the hazard presented by burning garments and suggests the basis of new tests for measuring this hazard. (Author's Abstract)

620. Berl WG and Halpin BM
FIRE RELATED FATALITIES: AN ANALYSIS OF THEIR DEMOGRAPHY, PHYSICAL ORIGINS AND MEDICAL CAUSES; Paper No. 3
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

Results to date of a continuing study of fire fatalities in Maryland are presented. Data are presented and analyzed on the demographic variables (location, age, sex, race) of people perishing in fires in the State of Maryland in 1972/1973, on the physical causes of these fires and on the most likely medical effects. Carbon monoxide as asphyxiant, cigarettes as ignition source and the disproportionate involvement of children and the elderly are pointed out, as are the contributory effects of prior alcohol ingestion. (Author's Abstract)

e. PHYSIOLOGY

621. Lawson SG and Rasbash DJ
HEAT STRESS IN FIRE FIGHTING
Fire Eng J, 36(102):16-20, 1976

A number of experiments have been carried out which simulated fire conditions in a compartment, and measurements of wet and dry bulb temperature have been made both near the ceiling and the floor. These measurements were designed to give information on heat stress conditions that might be encountered by firemen. In some of the experiments water was introduced in the form of a jet operated by firemen, of water spray applied to surface before the tests, or vapor from a humidifier. It was found that conditions that might give rise to high heat stress could be obtained from small fires, particularly if wetting down of the room surface had taken place. In one test in which the ceiling was wetted, a higher temperature was observed near the floor than near the ceiling - presumably as a result of stratification of a steam layer, formed at the ceiling. 7 figs, 2 tables, 6 refs. (Author)

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS
e. Physiology

622. Barnard RJ, Gardner GW, Diaco NV and Kattus AA
NEAR-MAXIMAL ECG STRESS TESTING AND CORONARY ARTERY DISEASE RISK FACTOR ANALYSIS IN LOS ANGELES CITY FIRE FIGHTERS
J Occup Med, 17(11):693-695, 1975

This study was undertaken to determine whether the apparent high incidence of heart disease in fire fighters is related to the usual risk factors associated with coronary heart disease or whether some unique phase of the life style of fire fighters might be responsible. The study consisted of investigating the electrocardiographic response to near-maximal exercise of 90 randomly selected fire fighters between the ages 40 to 59 along with documentation of their blood pressure, serum cholesterol and smoking habits. The fire fighters were then compared to a similar age group of insurance underwriters previously studied. It is suggested that ischemic heart disease may be job associated. 2 figs, 10 refs.

623. Hubbard H, Hunt T and Drause RD
JOB RELATED STRENGTH AND AGILITY TESTS
Publ Pers Manage, 4(5):305-10, 1975

The methodology used in the development of batteries of strength and agility tests as techniques in the selection of firefighters and police officers in Hartford CT, is described. The need for continued attention to details of the roles and uses of such tests is also pointed out.

624. Mehta AK and Wong F
MEASUREMENT OF FLAMMABILITY AND BURN POTENTIAL OF FABRICS. Massachusetts Inst of Technol; NSF RA/E-73-191, 331 pages, Feb 1973
Availability: NTIS PB-242 582/5

Two types of inanimate materials having the average thermal properties of human skin were studied. The thermal properties of both types of skin simulants, which were checked by exposing them to known radiant fluxes and monitoring the temperature response, were found to agree closely with the design values. A set of twenty different fabrics, widely used in apparel, were tested. The depth of thermal damage was found to increase approximately linearly with increase in the total thermal dose to skin, for the exposure times and the magnitudes of the heat fluxes involved in these specific fabric burning experiments. This finding indicates the possibility of rating the burn damage potential of fabrics, crudely, by only two measurements, namely flame spread rate and total thermal damage to skin. Measurements of the heat transfer rates from the leading edge to the fuel were conducted with the flame spread burner.

625. Pefley RK, Bell DM and Shiomoto GH
PHYSIOLOGICAL RESPONSE TO FIRE INDUCED HEAT ENVIRONMENTS. Santa Clara Univ, CA, Dept of Mech Engineering; ME 76-1, 85 pages, Jan 1976
Availability: NTIS AD-A021 509/5GA

An analytical thermal model is developed of sedentary humans which allows prediction of their transient response to changes in their thermal environment. This model is based in part on steady-state experimental evidence obtained from a human calorimeter. The predictive behavior of the model in terms of sweat rate is compared with evidence obtained from operating the calorimeter in a transient mode. Subsequently, this model is used to show the feasibility of creating fire-safe fallout shelters within reinforced concrete buildings. With minimum pressurized ventilation to these spaces, it is shown that rescue times of six to eight hours are available even though the shelter is adjacent to a major fire location. (Author)

626. Fristrom RM
THE SAMPLING AND ANALYSIS OF FIRE ATMOSPHERES; Paper No. 14
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

The problem of characterizing the chemical composition of a fire atmosphere as a function of spatial distribution and time is discussed. Complete characterization exceeds present technology requiring much greater than 10^{23} bits. Requirements can be reduced by division into appropriate time (t) - and distance (L) scales, e.g (i) gross atmosphere; for life and property hazard and detection purposes (L=1m.-t=10 sec), (ii) fire atmosphere detail; where temperature and velocity dominate and composition is less important (L=1cm - t = 1 sec). Composition measurements could be confined to the fire, doors, and windows. The presence or absence of gas pockets might be deduced from the temperature field, and (iii) microscale characterization of combustion processes (L = 10^{-3} cm - t = 10^{-} sec). This requires transient species concentrations which are best made in the laboratory.

Gross atmosphere characterization is of dominant importance for fires. Some recent studies are discussed. An idealized system is outlined utilizing a traversing probe which simulates breathing. Automated measurements following separations would allow evaluation of danger to respiratory tract, lungs and blood. This is feasible but requires equipment and computer interface development. Internat cooperation might hasten the development of such complex facilities.

f. PSYCHOLOGY

627. Klein A
PSYCHOLOGIST STUDIES PANIC
Fire Chief, 20(5):39-40, 1976

Experiments conducted at Tulane University by the author to study panic in a situation similar to a theatre fire showed that groups without a leader felt more fear. He concludes that lives could be saved if all public gathering places had trained individuals to lead at times of potential panic.

628. Canter D and Matthews RH
THE BEHAVIOUR OF PEOPLE IN FIRE SITUATIONS: POSSIBILITIES FOR RESEARCH.
Building Res Estab (UK), Fire Res Sta; BRE CP-11/76, 17 pages, 27 refs, Jan 1976

This report reviews the understanding of the behavior of people in fire situations and indicates those areas in which future psychological research may be of value. For such research to be fruitful it is argued that a measure of the effectiveness of behaviour in fire situations should be developed. The links this measure has to escape action and the way it relates to the recognition of the fire occurrence is also discussed. Finally, the roles of general attitudes towards fires and preparedness for a fire in a particular situation in influencing the eventual effectiveness of behavior are explored. (Author)

11. CODES, STANDARDS, SAFE HANDLING. IDENTIFICATION OF HAZARDS

a. CODES

629. Anon
NATIONAL BUILDING CODE
Amer Insurance Assoc, New York, NY; 1976 edit, 1976

This revised edition gives increased attention to life safety from fire and includes new fire safety requirements for highrise buildings. There is also an expanded classification of construction materials and a revised code for installing heating appliances and heating, ventilating, air conditioning, and blower and exhaust systems.

630. Anon
CODE OF PRACTICE, MEANS OF ESCAPE IN CASE OF FIRE
Greater London Council, London; 138 pages, 1974

631. Anon
FIRE PREVENTION CODE
Amer Insurance Assoc, New York, NY; 1976 edit, 1976

Written by American Insurance Association engineers, this revised edition has been expanded to include provisions for liquefied natural gas, storage of pesticides, gases used at health care facilities, and the manufacture and storage of fireworks.

632. Ferguson RS
THE SEPARATION OF TECHNICAL AND LEGAL FUNCTIONS IN BUILDING REGULATIONS
Fire J, 70(1):74-75, 1976

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

a. Codes

The author, session chairman at a panel discussion at the Life Safety Systems Conference sponsored jointly by the National Research Conference of Canada and the National Fire Protection Association and held in Ottawa July 23-24, 1974, summarizes the conclusions of the discussion. Since law and technology are different disciplines, technical necessities should be separated from the legal necessities, each to be written by experts in the field, resulting in a technical code and legal directives free of ambiguities, misunderstandings, and vagueness.

633. MacDonald RR
EMERGENCY LIGHTING
Fire, 68(851):607-609, 1976

The British Standard Code of Practice for the Emergency Lighting of Premises (BS 5266) was published in July, 1975, and gave long-awaited and much-needed guidance on installation standards. Some apparent shortcomings or misunderstandings of the code are identified by a local government officer directly involved with all aspects of emergency lighting, from the testing of manufacturers' equipment as to suitability for intended use to fault diagnosis after failure of an installation.

634. Bihr JE
BUILDING AND FIRE CODE: THE REGULATORY PROCESS; Paper No. 10
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

The complete regulatory process involves the application and enforcement of building and fire codes. Building codes govern new construction and embody standards designed to protect occupants and property from the hazards of fire. Fire codes are intended to preserve fire safety features of building codes and to govern fire safety practices involving the processes and uses within buildings. These codes must be compatible. Additional research is needed to address many of the newer fire problems now confronting regulatory officials. (Author's Abstract)

b. HAZARDS IDENTIFICATION

635. Ellis WJ
CHEMICAL INDUSTRY HAZARD ASSESSMENT
Fire Eng J, 36(101):22-26, 1976

The first essential of loss prevention and personnel safety is the identification and evaluation of hazard potential. Two methods of hazard assessment are described in detail. The first is one devised by ICI Ltd for internal insurance assessment of a plant. The primary basis on which the assessment is made is the inherent hazard classification associated with the plant under review in which marks of 0 to 3 are awarded fundamental criteria such as nature of the raw materials, nature of the products, type of process, heat content of the plant, reaction temperature and pressure, corrosion and erosion hazards and the domino effect (acceleration of a localized small incident). The second method is the Dow method, based on a rating system for a plant divided into units, each rated separately. 2 figs, 2 tables.

636. Anon
COTTON CAN BE DYNAMITE
Fire Command, 43(3):24-26, 1976

Information furnished by the Cotton Fire and Marine Underwriters is summarized in an article describing cotton fires, their sources, fire-plan preparations, fireground procedures, indoor and outdoor fire procedures, salvage operations, and restoration of protection. The sequence of salvage operations in baled cotton is listed in a separate box. 2 figs.

637. Belash VD, Boronin YuA, Sedin VM
CLASSIFICATION OF COMPARTMENTS AND SECTIONS OF GAS-CARRYING SHIPS BY DEGREE OF EXPLOSION AND FIRE HAZARD
Sb Tr VNII protivopozhar oborony, (5):99-106, 1974 (Russian)

c. SAFE HANDLING OF HAZARDOUS MATERIALS

638. Ashton WG
SAFE TRANSPORT OF HAZARDOUS GOODS
Fire Eng J, 36(101):5-8, 1976

An attempt is made to look at the overall problem of the transportation of hazardous substances by road and rail, principally by road. Sensible pre-planning based on an objective assessment of the hazards involved can, when allied to sound professional judgement, reduce the risks to an acceptable level. The themes treated in the paper relate to a definition of dangerous or hazardous substances, legislation (UK) dealing specifically with dangerous substances, the responsibilities of carriage, planning measures (routing, provision of informed and effective assistance in case of spillage, distinct marking of vehicles), hazard information system (the UK Hazard Information System - U.K.H.I.S), and training. A sample of a chemical hazards card (HazChem) is given. The paper was given at a symposium in Loss Prevention in the Process Industries held at Leeds University (UK) in 1975. 1 fig.

639. Sedin VM, Il'ina AA, Boronin YuA, Belash VD and Fedotov MN
PARTICULAR FEATURES OF THE TRANSPORTATION OF LIQUEFIED GASES AND THE FIRE-SAFETY PROBLEM IN GAS-CARRYING SHIPS
Sb Tr VNII protivopozhar oborony, (5):90-98, 1974 (Russian)

640. Anon
OIL AND HAZARDOUS MATERIALS SPILL INFORMATION RETRIEVAL SYSTEM. Environ Protection Agency, Washington, DC, Oil and Special Materials Control Div; EPA DF-75/001A, 17 pages, Aug 1975
Availability: NTIS PB-243 662

Guidance is given to those who prepare reports on spill episodes to the Division of Oil and Special Materials Control and who expect to access the system for devloping regional analytical studies. The increasing number of spills reports and the need for more accurate statistical analysis of episodes make it imperative that regions report promptly and in accordance with this manual in order that data are available to the Congress, EPA top management, the Office of Management and Budget, and the public. (Author)

641. Smith MF
HAZARDOUS MATERIALS TRANSPORTATION (A BIBLIOGRAPHY WITH ABSTRACTS). Nat Technical Information Service; PS 75/286/5ST, 131 pages, Feb 1975
Availability: NTIS PS 75/286/5ST

The transportation of explosives, rocket propellants, chemical warfare agents, industrial chemicals, liquefied natural gas, chlorine, and other hazardous materials are covered in this bibliography which contains 126 abstracts. All means of transportation are described. Accidents, economics, and statistics are also included in these reports. See also Published Search, NTIS PS 75-75/285, Hazardous Materials Waste Disposal. Radioactive wastes are excluded.

642. Anon
Transport of Hazardous Cargoes by Sea and Inland Waterway Symposium, International, Fourth, Proceedings; 1975, 26-30 Oct, Jacksonville, FL
Sponsor: US Coast Guard; USCG D-24-76, 619 pages, Oct 1975
Availability: NTIS AD-A023 505/1GA

This volume contains the papers, list of authors and list of registrants for the Fourth International Symposium on Transport of Hazardous Cargoes by Sea and Inland Waterways. The Symposium was held 26-30 October 1975 in Jacksonville, Florida, under the auspices of the US Coast Guard, with the scientific assistance of the National Academy of Sciences -National Research Council Committee on Hazardous Materials. Approximately three-hundred people from 14 countries registered and attended the four days of plenary sessions.

d. STANDARDS

643. Maier PL
STANDARDS AND CONSUMERS: A PROPOSAL FOR REFORM
Fire J, 70(3):37-39, 1976

The large number of inadequate consumer product standards and the extent to which they are flawed indicate the need for reform of the present standards-writing system by attracting greater consumer participation on standards-writing committees. The "Standard for Mobile Homes" is used as a basis for a critique of the existing system; mobile home owner organizations exist in about a dozen states, from which technically qualified persons might be drawn for representation in standards-writing committees.

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS
d. Standards

644. Ramsey JD
HEAT STRESS STANDARD. OSHA'S ADVISORY COMMITTEE RECOMMENDATIONS
Nat_Saf_News, 111(6):78-82, 1975

OSHA has asked NIOSH to supplement the original heat stress criteria document for the establishment of a heat stress standard. This article considers the proposals under discussion, the purpose of the standard, definitions of terms and special questions involved, threshold wet bulb globe temperature (WBGT) values, work practices and levels. 4 figs, 2 tables, 4 refs. [Safety in Mines Abstracts]

645. Braun V, Cobble VB, Helzer S, Krasny JF, Peacock RD and Stratton AK
BACK-UP REPORT FOR THE PROPOSED STANDARD FOR THE FLAMMABILITY OF GENERAL WEARING APPAREL. Nat Bureau of Standards, Center for Fire Res, 46 pages, 11 figs, 4 tables, 32 refs, Jun 1975

A "Proposed Standard for the Flammability of General Wearing Apparel" was submitted to the Consumer Product Safety Commission in February 1976. This report discusses the reasons for the choices of experimental arrangement for the flammability test and the choices of pass-fail criteria. The specimen is cylindrical, to simulate a garment, and to eliminate framed specimens which often burn differently from garments. Criteria for the fire hazard of fabrics are the time to ignite with a specified gas flame and the heat transferred to sensors inside the burning specimen. The proposed standard specifies that fabrics which transfer little heat to the inside of the specimens could be used in all garments but would have to be used in garments which cover most of the body and/or fit loosely. They would also have to be used in children's dresses and skirts (children's nightwear is covered by an earlier standard). Fabrics which transfer larger amounts of heat, and thus have larger injury potential, could be used in garments with normal or tight fit such as most present-day shirts, slacks, etc. If such fabrics ignite in one-half second or less, they would be excluded from use in garments. These provisions in the proposed standard were based on the need to reduce the number and severity of apparel fires with minimum economic and technological impact on the fiber, textile, and apparel industry. The present report summarizes the available knowledge in the area covered by the standard, and points out areas in which additional work is indicated. (Author)

646. Stevens RE
A PLACE FOR VOLUNTARY STANDARDS; Paper No. 11
Fire_Standards__and__Safety__Symp,__Final Program_and_Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

Voluntary standards are defined as standards used voluntarily. Of the more than 23,000 voluntary engineering standards in use today, most are commercial standards. The preparation of these standards represents the contributions of thousands of experts who write "consensus" standards that in some way affect every product, service, process or environment. There have been recent pressures from both governmental and public interest groups for improvements in the quality and relevance of standards. This challenge has been accepted by standards organizations which have attempted to permit both quicker action on standards as well as increased information on the relevance of the standard to fire problems. The future of voluntary standards will be assured if those standards are adequate and their use satisfactory. (Author's Abstract)

647. Witteveen J and Twilt L
INTERNATIONAL STANDARDIZATION; Paper No. 13
Fire_Standards__and__Safety__Symp,__Final Program_and_Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

Advantages, progress and problems encountered in attempts to achieve international standardization on fire safety are discussed. Four basic requirements are proposed: the system of international rules must be objective, practical, mandatory and consistent. Considering the state of the art, the fulfillment of these basic requirements is subject to some substantial constraints. A very important constraint appears to emerge from the inconsistency between the quantification of levels of protection and the quantification of measures to meet the required levels. Other constraints follow from political and legal considerations. A discussion on these constraints is presented. Moreover recommendations are given to face the identified problems. (Author's Abstract)

648. Thomas W JR and Willis CL
NATIONAL MANDATORY FIRE SAFETY STANDARDS;
Paper No. 12
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

This paper presents a brief review of the events leading to the establishment of the Consumer Product Safety Commission, describes their accident information data system, and briefly reviews the procedures through which they reach decisions with regard to establishment of safety standards. The Commission has broad regulatory authority over thousands of consumer products. Mandatory fire safety standards for bookmatches, aluminum wire, and television receivers are being developed or planned under the Consumer Product Safety Act, and two other standards will have significant fire safety aspects. Regulation under the Flammable Fabrics Act has resulted in mandatory standards for children's sleepwear, clothing, carpets and rugs, and mattresses. The paper reviews some of the developmental work on these proposed standards and furnishes information on the nature of requirements of those standards presently in effect. (Author's Abstract)

12. INSURANCE, ECONOMICS OF LOSS AND PREVENTION

a. INSURANCE

649. Bardell R
THE INSURERS' ROLE IN FIRE PREVENTION
Fire, 68(852):17-18, 1976

Insurers recognize that fire wastage is a loss to the community as a whole and are concerned with playing their part in it. They are concerned with keeping down the cost of the coverage they offer, which may be done if fire wastage is kept to a minimum. Considerable funds are expended in the provision of an advisory and survey service in the shape of fire surveyors. The underwriting policy, which regulates the cost of coverage by penalizing poor risk features and encouraging good risk features by allowing lower rates, also assist in fire prevention. Their positive attitude is also shown by their setting up and/or supporting organizations which provide advisory, educational, research and testing services, and by their financing of salvage corps.

650. Goetsch H
FOREST FIRE RISK IN AUSTRIA
Allg Forstztg, 86(3):79-80, 1975 (German)

The forest-fire risk cannot be calculated in regard to time and magnitude for any individual forestry business. But a sum total of risks is a variable which can be calculated theoretically by the rules of probability calculus. Forest-fire insurance is based on such calculations. The principal risk factors revealed by forest-fire statistics are: the season (spring most frequent); age of stand (young stands more susceptible); weather conditions; man (43 percent of all forest fires in Austria are caused by negligence, 30 per cent by railroads). The forest-fire risk can be decisively influenced by forest management. Suitable selection of tree type, adequate maintenance, layout of optimal road and path networks, as well as allowance for breaks, are suitable measures, when supplemented by the establishment of an alarm and action system, to reduce forest-fire risk. (Author's Abstract)

b. LOSSES

651. Munson MJ
RESIDENTIAL FIRES AND THE URBAN POOR
Fire J, 70(1):59-61, 1976

Population density figures are calculated for each borough of New York City and plotted against the incidence of structural fires, with application of a least-squares linear regression line fitted to the five data points to reveal the significance of the slight positive slope. The relationship between high-density residential areas and the low-income poor is demonstrated. The fire losses and resultant dislocations are symptoms, or fire effects, to which greater attention must be devoted. 4 figs, 1 table.

652. Anon
UK FIRE DAMAGE COMPARED WITH THOSE OF OTHER COUNTRIES, 1970-1974
Fire_Prev, (113):38-39, 1976

The Fire Protection Association (UK) survey of fire losses in developed countries shows that, on the basis of percentages of gross national product destroyed by fire, the UK lost more in 1974 than any other country included in the chart, comparing the losses of 10 countries, except for Australia. 1 table, 1 photo.

653. Minaev SN
CONTRIBUTION TO THE PROBLEM OF DETERMINING FIRE LOSSES
Vopr_ekon_pozhar_okhrane, (3):51-57, 1974
(Russian)

It is proposed that the losses incurred from uninsured personal property of citizens and the expenditures involved in fire suppression by workers and the personnel of enterprises be taken into account to determine fire losses. (Author)

654. Vervalin CH
LATEST API/NFPA FIRE LOSS REPORT
Hydrocarbon_Process, 54(6):Sec 1: 149-50, 1975

Statistical data are cited for fire losses in the US oil processing industry in 1972 and 1973. General information is given on the most typical fires with large life and property losses. 3 tables.

655. Noste NV and Davis JB
CRITICAL LOOK AT FIRE DAMAGE APPRAISAL
J_For, 73(11):715-9, 1975

Discussion of fire-damage appraisal in relation to fire-protection planning shows a need for a standard appraisal system on all federal lands. Fire control costs and damages on an interior Alaska and a northern Minnesota fire are compared; application of both Bureau of Land Management and Forest Service appraisal criteria to the Minnesota fire produces considerable differences. 12 refs.

656. Fowkes N and Land R
THE VALUE DESTRUCTION OF A HOME BY FIRE.
Harvard Univ, Div of Eng and Applied Physics; TR-2, 27 pages, 14 refs, Jan 1975

The primary purpose of this investigation is to determine (in a usable way) a relationship between the physical destruction of a home caused by fire (either directly by fire or smoke destruction, or indirectly by water damage) and the associated repair, replacement, salvage and demolition costs for eventual estimation of the financial effectiveness of various preventive and control methods. The findings reported in this paper will be combined with the best available fire spread data in a later report in an attempt to determine the rate of value destruction of an imagined home under a variety of physical circumstances.

c. RISK MANAGEMENT

657. Abolentsev YuV
RISK LIMITS IN THE ECONOMIC EVALUATION OF THE NUMBER OF FIRE UNITS FOR URBAN PROTECTION
Vopr_ekon_pozhar_okhrane, (3):31-37, 1974
(Russian)

A risk limit which makes it possible to calculate the contribution of economic factors should be introduced into the existing method of determining the sufficient number of fire units in cities. (Author)

658. Minaev SN and Gavriley VM
ESTIMATE OF THE FIRE PROTECTION LEVEL REQUIRED FOR NATIONAL ECONOMIC ENTERPRISES
Vopr_ekon_pozhar_okhrane, (3):58-67, 1974
(Russian)

It is proposed that the fire protection level be determined with a view toward reducing or eliminating hazardous fire factors. Nomograms are presented for determining the tolerable fire losses and the actual level of fire protection. (Author)

659. Woolhead FE
PHILOSOPHY OF FIRE RISK MANAGEMENT
Fire_Eng_J, 36(102):5-6, 1976

Company fire-safety policies should delegate specific duties and responsibilities to all members of line management under a nominated fire director or senior fire-safety manager. The established duties and responsibilities should include fire prevention, fire protection, damage control; fire loss control and contingency planning are reserved for executives and specialist managers. The continuous and effective maintenance of these measures will undoubtedly reduce the threat of loss.

660. Jach W
FIRES IN PLANTS PROCESSING PLASTICS
VFDB_Z, 25(1):32-35, 1976 (German)

The use of synthetic materials of varying chemical structure and mechanical, fire and heat properties is becoming more and more widespread. This growing tendency in commerce and industry must be given special attention by the insurance expert, on the basis of the following risk complexes: a) risks in processing basic synthetic materials; and b) the uses of plastics in building, appliance and vehicle construction. Three particularly instructive cases of fire are discussed and risk factors for fire protection practice on the part of the insurance expert are determined. 2 figs.

661. Stevens AM
SAFE STORAGE AND HANDLING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS
Prof_Saf, 20(12):24-7, 1975

The author stresses that storing flammables and combustibles in approved-type containers and minimizing exposure of the liquids to air while in use are the keys to reducing this fire hazard.

d. SALVAGE

13. STATISTICS

662. Kasholkin BI and Poedintsev IF
STATISTICS OF FIRES FROM ELECTRICAL EQUIPMENT
Vopr_ekon_pozhar_okhrane, (3):68-72, 1974 (Russian)

663. Anon
FIRE DEPARTMENT STATISTICS FOR 1975
Brandschutz, 30(6):162-165, 1976 (German)

The Association of German Fire Departments presents the 13th annual report on federal fire department statistics in the form of tables of organization, fire engines, aerial rescue vehicles, appliance, equipment and service vehicles, miscellaneous vehicles, trailers, number of calls, etc. for the volunteer fire departments and industrial fire brigades and, in part, for the professional fire departments. The figures reveal that on December 31, 1975, the Federal Republic had 10,231 voluntary fire departments with 826,735 members, 65 professional fire departments with 18,814 active firemen, 1,237 industrial fire brigades with 40,868 men and 2,927 youth fire departments with 61,537 members. 11 tables.

664. Anon
FACTS AND FIGURES ABOUT THE 15,000-POUND PLUS FIRES IN 1974
Fire_Prev, (112):19-23, 1976

The 1210 fires in Great Britain which caused damages of 15,000 pounds or more during 1974 are analyzed in eight charts and tables giving breakdown of fires by occupancy, grading of losses, fire costs related to production, industries in which fires most frequently grew into 15,000 pounds plus fires, how, where, and when the fires started, and the age of the premises involved. 2 figs, 8 tables.

13. STATISTICS

665. Mori H
ACTUAL RECORDS OF FIRE HAZARDS OF AUTOMOBILES
J Soc Automot Eng Jap, 29(7):691-701, 1975 (Japanese)

The causes, circumstances, and effects of automobile fires are analyzed on the basis of statistical data obtained in Japan in 1970-1974. The recorded fires are classified by the following marks: season, time of day, cause, location of the seat of the fire, type and make of vehicle, responsibility for the fire, etc. The data were collected from all types of automotive transportation. The main fire cause was highway accidents, especially collisions and vehicles running into stationary objects for one reason or another. The typical versions of the location of vehicles relative to each other at the time of the accident are illustrated graphically, as well as of the location of the vehicle relative to fixed objects when the fire broke out. The most vulnerable body parts for vehicles of the different kinds and makes are analyzed in detail from the viewpoint of fires occurring upon impact. The part played by different vehicle structural components in the breakout of fires is evaluated. This part is clearly illustrated by the following data taken from an analysis of 90 incidents of fire: motor in 14 cases (15.6 percent), fuel tank in 13 cases (14.4 percent), coverings of seats and other internal components of the cab in 9 cases (10 percent), fuel line systems, including filters, in 8 cases (8.9%), and carburetor in 46 cases (51 percent). This type of classification was made for each of the kinds of transportation vehicle considered. The part played by various factors influencing the creation of accident situations was analyzed similarly: weather conditions, state and nature of road paving, etc. 6 figs, 12 tables.

666. Tovey H
THE NATIONAL FIRE INCIDENT REPORTING SYSTEM: A KEY TO FIRE HAZARD QUANTIFICATION; Paper No. 2
Fire Standards and Safety Symp, Final Program and Abstracts; 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD
Sponsor: NBS Inst for Applied Technol and ASTM Committees on Fire Standards

The National Fire Incident Reporting System is the collection of national fire loss data for fires attended by the fire service. It includes information on factors involved in fire ignition, spread, and extinguishment. It has been developed with recognition of the importance of serving the needs of state, regional, municipal and local fire jurisdictions, as well as those at the Federal level. A representative selection of states has been identified for cooperative preliminary studies of this system. The system is based on use of the fire data reporting procedures developed by the National Fire Protection Association. Data elements have been selected as usual with many compromises to provide the most versatile use of data readily available. A review is presented of the way in which the data collected could be used in locating and analyzing fire problem areas as they occur. Brief mention is included on work under way to report and classify textile type fire incidents on an international scale. (Author's Abstract)

667. Tyrrell EA
FIRE INCIDENTS INVOLVING FLAMMABLE LIQUIDS, GAS AND DRY EXPLOSIVES. Nat Bureau of Standards, Center for Fire Res; NBSIR 75-784, 59 pages, Oct 1975
Availability: NTIS PB-246 862/7GA

From the NBS Flammable Fabrics Accident Case and Testing System as of December 1973, flammable liquids, gas, and dry explosives were found to be involved in 832 incidents, injuring 863 victims. Volatile flammable liquids represented 77 percent of the incidents; 72 percent of these liquids were gasoline. Male victims out-numbered females more than 3 to 1. Young adults, ages 21-45, and youth, ages 13-20, were injured most frequently. Children and youth were injured primarily through what was considered as play activities. Adults generally were injured while engaged in activities traditionally considered as being oriented to the particular sex involved. Streetwear, particularly shirts/blouses, was reported most frequently as igniting first. Thirtysix percent of the fabrics represented in these incidents were contaminated with a flammable liquid.

AUTHOR INDEX

A

ABBOTT C...............126
ABBOTT NJ..............168
ABDURAGIMOV I...........32
ABOLENTSEV YUV.........657
ABRAMS MS.........190, 254
ACREE RL................87
AFFENS WA..............132
AGAWA M...........300, 304
AKAOGI I...............410
ALDERSON SE............601
ALGER RS.....329, 531, 532
ALMUS FW...............309
ALPERT RL..............199
ALVARES NJ.............307
AMARO AJ...............170
AMATO G................466
AMES SA................144
AMMOSOV FA.............303
ANDERSON J.............166
ANDERSON W.............454
ANDRENUCCI M...........559
APOSTOLOV AI...........253
ARAI K.................409
ARISTOVA EM............136
ARMSTRONG A............581
ARNAULT P...133, 177, 178,
...............179, 259
ARVIDSON JM............143
ARYA PK.................82
ASHTON WG..............638
AUDET NF.....485, 487, 488
AUVINET J..............424

B

BABRAUSKAS V.........65, 66
BACK KC................603
BAJPAYEE TS.............82
BAKENHUS G.............225
BALAGIN PG.............319
BALANOFF T.............618
BALDWIN R..........97, 265
BALDWIN RC........598, 604
BALSTER D..............326
BAMERT E...............273
BANCROFT WL............344
BANKSTON CP..147, 151, 159
BARABANOV LP...........462
BARDELL R..............649
BARKDULL WL............555
BARNARD RJ.............622
BARTSCH G..............482
BATES EB...............578
BEENKEN HD.............346
BEERY GT...............429
BELASH VD...404, 504, 637,
...................639
BELL DM................625
BELYAEV VM.............500
BENJAMIN IA.......145, 201
BERAN DW...............104
BERCAW JR..............619
BERL WG................620
BERNADINER MN...........79
BERRY DR..........381, 382
BESPALYY IK............360
BEST R..................22
BIHR JE................634
BIJLAARD F.............176
BILKUN DG..............500
BIRKY MM.....594, 598, 601
BLAVY A................421
BLIGH J................573
BLOCK I.................81
BLOMQUIST DL...........309
BLOOM F................548
BOCK AE................324
BODASHEVSKIY IS........463
BONDAREV AG............357
BORONIN YUA..404, 637, 639
BOTTERI BP.............426
BOWSER ML..............103
BOYARS C...............134
BOYD H.................202
BOYLSTON EK............160
BRAUBACH H-O...........365
BRAUN E...........183, 432
BRAUN V................645
BRAVEN KD..............107
BRECKENRIDGE K.........492
BREDEN LH.........195, 197
BREEN DE...............333
BRELOER F..............351
BRESLER B..............175
BRICKER RW..............53
BRIESSE GL.............609
BRIGHT RG....235, 238, 331
BROELL R...............521
BROMME H................34
BROODO A...............581
BROWN JK...............340
BRUNS W................560
BRUSENTSEV GK..........291
BRUSHLINSKIY NN...453, 495
BRYAN JL...............284
BUB H..................260
BUCHBINDER LB..........617
BUDD DC................591
BUDNICK EK.............181
BUKLAN GI..............354
BUKOWSKI RW.......235, 243
BURGESS D...............85
BURGESS J..............275
BURROS RH..............209
BURRY PE...............245
BUSHEV VP.........270, 396
BUSSENIUS S............370
BUSSEY AH..............343
BUTLIN RN..............100
BUTTE JC...............149
BYCHKOV AI.............288
BYRD J.................275
BYRD NR................237

C

CALVIN Y...............437
CAMPBELL JA.............31
CANDILORO T............573
CANTER D...............628
CANTRELL JR............605
CAPLAN Y...............615
CAPNER EL..............532
CARHART HW.............510
CASEY J................542
CASSANOVA EA...........151
CASSANOVA RA......147, 159
CERRINA FG.............297
CERVENAK MM............606
CHAIKEN JM...456, 459, 575
CHAN WK................437
CHANG EP...............113
CHARKOV VP.............373
CHATFIELD DA.....150, 154,
....................158
CHERNENKO NA............79
CHI LL.................437
CHIANTA MA.............130
CHIEN WP...............157
CHIN PS................167
CHRISTIAN WJ...........243
CHRISTOPHER AJ.........119
CHU E..................169
CLARK JE.................4
CLARK KJ...............169
CLARKE FB..........59, 613
CLODFELTER RG......91, 429
COATES RJ..............491
COATS AW...............601
COBBLE VB..............645
COHEN J................233
COLLINS HE.............392
CONNELL WM........359, 438
CORDES EH..............344
CORLETT RC.............200
CORRIE JG..............338
COTTON PE..............206
COTUGNO LA.............282
COWARD SKD.............256
COX G..................101
CROCE PA............92, 204
CROSSMAN ERFW..........400
CULVER CG....58, 257, 258,
....................271
CUMMINS JM.............149
CUSTER RLP.............325

D

DALHOFF W..............127
DALVERNY LE............242
DAMANT GH...............83
DAVIS JB...............655
DAVIS S................399
DECHIME L..............279

AUTHOR INDEX

DECICCO PR.............188
DEEMING JE.............340
DEGRAVE A...............54
DEGROOT WF.............167
DEMOULINS P..............8
DERIS J.................72
DIACO NV...............622
DIECKMANN J............387
DIETZ R..........458, 468
DILLON JC..............588
DIMEFF J...............230
DIMEO M.................23
DINGER BG..............598
DIXON HM...............274
DOBKO II...............352
DORMONT P..............566
DRAUSE RD..............623
DREBINGER K...........537
DRESSLER DP............593
DUBOVIK VI.............303
DUNN JJ................353
DURBETAKI P....87, 93, 111
DUSSA K..........522, 524
DYER RF................596

E

EBERLY R...............530
ECKEL JS...............469
EDELMAN J..............233
EDSER MH...............135
EHM H..133, 177, 178, 179,
....................259
EINHORN IN..150, 154, 158,
.....592, 595, 597, 598
ELLIS WJ...............635
EMEL'YANOV AP.....512, 513
ENOMOTO K..............294
ERDELYI BJ.............221
ESCH VH................596
ESTANISLAO AF...........28
EULENBURG P............549
EVELEIGH C.............239
EVERS H................537

F

FANG JB.......68, 120, 187
FARIA LE...............478
FAVAND M...............424
FEDOTOV MN...404, 405, 639
FERGUSON RS............632
FERNANDEZ-PELLO A.......71
FERONI GC..............366
FERRER JM..............591
FERRIE M...............289
FEWELL LL..............272
FIALA R..........522, 524
FIELDS LJ..............606
FINK ZJ................242
FINNERTY AE............118
FISH RH................422
FISHER JM..............552
FISHER R...............615
FISHER RW..............198
FITZGERALD PM..........333
FLOCH F................591
FOEHL JM...............398
FOLSOM F...............607
FOLTIER C..............180
FOOKSON A.......228, 240
FORSHEY DR.............336
FOSTER JF..............440
FOWKES N...............656
FOX DG.................234
FRECHOU G..............417
FRICK HR...............330
FRIEDMAN R.........94, 215
FRISTROM RM............626
FRY JF.................239
FUDGE WL...............315
FUKALOV VG..357, 504, 505,
....................516
FUNG FCW..........99, 308
FURMAN RW..............341
FURUHATA T.............409
FURUKAWA K.............321
FUTRELL JH.............158
FYFFE DE...............442

G

GAEVOY GM..............500
GAGLIANI J.............283
GALIL F................161
GANDEE GW..............429
GANN RG................510
GARAVAGLIA MM..........606
GARDNER GW.............622
GARDNER L.......415, 419
GAVRIKOV NF............406
GAVRILEY VM.......277, 658
GAVRISH YUV.......296, 517
GAWIN WM...............238
GEHL JM.................20
GETZ MR................312
GEVLICH VN.............500
GILMORE J..............581
GILWEE WJ, JR..........422
GIORDANO TA............484
GODFRIED LM............423
GOETSCH H..............650
GOLDEN JV..............214
GOODMAN EI.............155
GORKUNENKO VM..........499
GORNYY AV..............295
GOULD AB................27
GRAVES KW..............436
GREGORY CE.............385
GREIN W................365
GREUER RE..............388
GRIN GV.....292, 296, 375,
....................517
GROSS D...........76, 145
GRUMER J...............389
GRUNNET ML.............598
GRUPP H................148
GUILLEVIC P.............50
GURINOVA EL............501
GUSEV VN...............295
GUSTAFERRO AH..........254
GUZDAR AR.........381, 382

H

HAEGGLUND B............106
HAGGLUND A.......219, 251
HAHL RG.................15
HAINES DA..............342
HALPAAP W..............301
HALPIN BM....558, 615, 620
HARDEE HC..............141
HARDER HJ...............30
HARDS DJ...............186
HARPER A...............240
HARRINGTON JJ..........343
HARRIS AM..............603
HARRISON GA.............57
HASEGAWA K..............98
HASHEGAWA K............302
HATIO K................410
HAUSNER J....566, 573, 574
HAZLETT RN.............132
HEINSOHN G.............248
HEISS FW...............563
HELZER S...............645
HEMMETER PA............543
HENDRICK TE............563
HENNINGSEN LA..........320
HERTZBERG M........85, 241
HESELDEN AJM.......67, 97
HEYWANG R..............395
HICKEY HE..............558
HIGER AL...............344
HIGGINBOTTOM GS........131
HILADO CJ....78, 128, 185,
....................599
HILEMAN FD.......158, 595
HILL R.................182
HIROSHIGE I............408
HIRSCHBERG J............58
HOLMES WO..............467
HOLMGREN RB..............3
HOLVE DJ...............196
HORD J.................143
HORII K................294
HORTON ML..............603
HOUSER JL...............57
HUBBARD H..............623
HUGHES RT..............535
HUNT T.................623

I

IDEN DJ................327
IDING R................175
IFSHIN S................44

AUTHOR INDEX

IGNALL EJ....456, 459, 571
IL'INA AA..............639
ILICHKIN VS............589
IMADZU H...............302
ISAEV MN.........318, 460
ISIMURA YU.............368
ISMAN WE...............455
ITSKOV AI..............293
IVANOV AF..............460
IVANOV AV..............136
IVANOV EN.........220, 534

J

JACH W.............33, 660
JACKSON RHF............471
JACOBS BI..............444
JACOBS DT..............446
JANES DF.................1
JANSKY D................51
JANSON SW..............465
JANSSON R..............106
JASON NH................14
JELLINEK HHG...........585
JEPPSEN RB.............604
JERNIGAN JB.............13
JOHANNSON G............127
JOHN R.............80, 527
JOHNSON GA.............336
JOHNSON GR.............182
JOHNSON N...............89
JOHNSON VJ.............342
JOHNSON WH.......329, 531
JORDAN KG..............619

K

KAHNAU HW..............123
KANURY AM........196, 307
KARATAEV AK............376
KARLSCH D.........348, 550
KARPOV VI........339, 500
KASHIWAGI T............108
KASHOLKIN BI...........662
KATTUS AA..............622
KAYSER EG..............134
KAZAKOV MV...339, 499, 500
KELLEY CS..............105
KERR JW................579
KHARLAMOV BN.....296, 517
KHOROL'SKIY VT.........378
KIENINGER W............123
KIMSTACH IF............498
KING TY................156
KIRSTEN R..............113
KISELEV VF....63, 162, 407
KISSEN AT..............486
KITANI S...............321
KLEIN A................627
KLEIN DP...............181
KLESOW GF..............317
KLITGAARD PS...........255
KOJIMA M................98
KOLENOVSKIY AS.........354
KOLESAR P..............567
KOLGANOVA MN...........165
KONISI M...............294
KONOPKIN NF............460
KONYASHEV VI...........405
KOPLON NA...............43
KORNSAND NJ............397
KOROL'CHENKO AYA.......136
KOTOV AA..........357, 505
KOURTIDES DA.....149, 185, ...422
KOZLYUK AI..292, 313, 375, ...377, 517
KRASNER LM.............333
KRASNY JF....129, 142, 645
KRUPPA J....133, 177, 178, ...179, 259
KRYLOV E................32
KUDIN VV...............354
KULAKOVSKIY AA.........503
KUNG H-C...............337
KUPFERMAN Z............487
KUSAKABE S.............322
KUSHNAREV AM.....291, 374, ...518, 519
KUSHNER J..............257
KUVSHINOFF BW......13, 218
KUZ NA.................292
KUZNETSOV VV...........461

L

LACROSSE RA............125
LAIRD D................211
LAMB RTB...............451
LAND R.................656
LARSON RC.........576, 577
LATHROP JK.............547
LAUB B.................169
LAUGHRIDGE FI....329, 531
LAURIN J-C.............276
LAWSON SG..............621
LAY D..................231
LEASE W................384
LEDIRAISON J-C.........180
LEE BT.................210
LEE DO.................141
LEE J..................175
LEE L...................58
LEESE A................545
LEON HA................149
LEONARD PF..............27
LEONOVICH AA...........162
LEVINE S...............392
LEVITES FA.............396
LIEBMAN I..............390
LIN TD.................173
LIPSKA AE..............170
LITTON CS..............241
LIVINGSTON WL....310, 316, ...323
LLOYD JR...............214
LOGINOV FL.............360
LORENZEN H.............278
LOVELOCK RT............140
LUCHA GV................37
LUGAR JR...............430
LUPANOVA LI........29, 277
LYONS D.................55
LYONS JW................60
LYSENKO EP.............378

M

MACCARTHY BJ...........367
MACDONALD JA...........425
MACDONALD RR...........633
MACEK A.................88
MAGUIRE HM.............580
MAHENDRAN P............526
MAHOOD L...............420
MAIER PL...............643
MAIN WA................342
MAINSTONE RJ............41
MAKAROV KN.............501
MAKAROV VI.............460
MALHOTRA HL......194, 264
MALOFEEV NI............506
MANN DB................143
MANNO AD...............533
MANSFIELD JA...........272
MANZYUK ES.............519
MARCUSSEN WH...........149
MARION KM................2
MARKSTEIN GH............72
MARKUZON IA............453
MARTIN JR..........77, 84
MARTIN SB..............213
MARTYNENKO VI..........407
MARZETTA LA............616
MASER K..........381, 382
MASER KR...............387
MATSUBASI S.............98
MATSUK MA..............339
MATSUKAWA V............410
MATTHEWS RH......535, 628
MAXWELL MH..............46
MAY M............228, 240
MCCABE R................58
MCGARVEY AR............216
MCGARY RA..............371
MCKEE RG.........329, 531
MCKINNON GP.............17
MCLAREN GW.............132
MCNAMARA WJ............328
MECKEL L...............138
MEHLTRETTER CL.........281
MEHTA AK...............624
MEIER H-U..............290
MEISTERS M.............197
MELDRUM J..............539
MELINEK SJ..............67
MENDES RF..............554
METAL'NIKOV VO.........375

AUTHOR INDEX

MEYERS PR..............471
MICKELSON RW.....150, 154,
....................158
MILEEV EB..............360
MILLER B.......77, 84, 112
MILLER GE..............458
MILLER RE..............413
MILLER RH..............605
MILLER SC..............345
MIN K..................121
MINAEV NA..............460
MINAEV SN...439, 509, 653,
....................658
MINNERS W..............392
MODAK AT...............199
MOLL KD................582
MOLLINS RB.............584
MOLTER JD..............481
MOMBACH J..............359
MONAGHAN DA.......381, 382
MONAKHOV VT............137
MONARCHI DE............563
MOORE LD................39
MOORE VA...............392
MORI H.................665
MORIKAWA T.............586
MORRIS J...............394
MOSS AZ................619
MOUSSET P..............180
MULLER LL..............160
MUNROE LR..............130
MUNSON MJ..............651

N

NAGAI I................294
NAILEN RL..............610
NAMURA S...............410
NASH P...25, 247, 334, 523
NAVEDA OA...............93
NELSON GL..............124
NEUFELD GR.............249
NEWMAN JS..............199
NORTON ML...............28
NOSTE NV...............655
NOVOTNY JL.............214

O

OBUKHOV FV...............19
OHLBAUM MK.............486
OLIMPIEV VG............174
ONNEMARK B.............106
ORLOFF L................72
ORLOV VN...............373
OTEY FH................281
OTTOSON J..............613
OVCHAROV EA............518

P

PAABO M...........145, 601
PABST S................544
PACKHAM SC.............598
PAGNI PJ.....110, 262, 437
PALMER KN..............146
PANCIERA VW............392
PANOVA RG..............439
PANTO JS...............168
PARK S.................584
PARKER JA....149, 185, 422
PARKER WJ....145, 203, 210
PARROTT BF...............45
PAUL KT................146
PAVLOV GP..............405
PAVLOVA LV.............406
PEACOCK RD.............645
PEARL MH...............471
PEFLEY RK.........307, 625
PENDERGAST R...........452
PERRY LB................27
PETAJAN JH........598, 604
PETRELLA RV............330
PETROVSKIY VB..........519
PFEFFERLI W..............9
PIERGELLINI JR.........130
PIGMAN W...............400
PINKEL II................86
PION RF................117
PITT A...................90
PITT B.................601
PLANE DR...............563
PLONUS MA................35
PODKOL'ZIN GP..........463
POEDINTSEV IF..........662
POHL KD................114
POLTHIER K.............223
PONCHIK SKH............377
POPOV VA...............377
POWELL EA....147, 151, 159
PRANOV BM..............495
PRIVALOV NI............291

Q

QUINTIERE JG....69, 73, 75

R

RADFORD EP.............615
RAFTERY M..............152
RAGOT MR...............349
RAISHER DW...............59
RAMSEY JD..............644
RARDIN RL..............442
RASBASH DJ.............621
RAYNHAM EA.............116
REEVES JB..............327
REILLY TC..............361
REUTT VCH..............288
RICCITIELLO SR.........272
RICHARDS CG............335
RICHMOND JK............390
RIDER KL....444, 562, 564,
..........570, 572, 573
RIEBER M...............587
RINARD G...............282
RINSEN M...............207
ROACH AP.................52
ROBERSON EC............372
ROBERTS AF...............95
ROBERTS J..............448
ROBERTSON MA.............37
ROBINSON DJR...........416
ROBINSON RS............593
RODIONOV GM............270
ROGOWSKI ZW..............90
ROLLHAUSER CM..........430
ROMANOV EI........407, 589
ROOK A.................138
ROSE RF................604
ROUX HJ................217
ROYTMAN MYA............218
ROYTMAN VM.............269
RUMBERG E..............192
RYAN PW................158
RYBALKO SF..313, 374, 518,
....................519

S

SACHKOV AF.............295
SAHOTA MS..............262
SAITO M................300
SAITO Y................410
SALOVEY R..............113
SALSE E................173
SALUJA TS................28
SANDERSON S..............89
SARKOS CP....153, 332, 428
SASAKI G...............410
SAUNDERS P.............471
SCHAFRAN E.............434
SCHALIT L..............211
SCHEIDWEILER A.........244
SCHERMERHORN DA........345
SCHMITT CR.............511
SCHNELL M..............236
SCHNEYER G.............211
SCHOLZ W...............538
SCHOOLEY FA.............37
SCHORR M...............608
SCHURTER W...............49
SCOTT JT..........145, 187
SEADER JD..............157
SEDIN VM....404, 637, 639
SEEGER PG..............525
SEELEN RP..............583
SEMIKOV VL........472, 536
SHAFIZADEH F...........167
SHANESY C..............568
SHARROD D..............135

AUTHOR INDEX

SHAW CY................222
SHCHELKUNOV VI.........268
SHCHERBAKOV MF.........460
SHCHETSER GM...........313
SHERATTE MB............237
SHETSER GM.............519
SHEYNINA LV.......252, 263
SHIOMOTO GH............625
SHORTELL R.............573
SHOWALTER TW...........469
SHUL'GA YUN............291
SHURYGIN AP.............79
SIDORYUK VM........63, 407
SIEGEL J...............441
SILCOCK A...............42
SIMA M...........300, 304
SIMS IJ................520
SINGLETON DW...........569
SIRIGNANO WA............64
SKORNIK WA.............593
SMART PMT..............198
SMIRNOV KP.............405
SMITH BA...............569
SMITH CO...............306
SMITH MF...............641
SNOW JC.................28
SOBTI MK...............218
SOLODOVNIKOV AM........285
SOLOMON SS.............464
SOLOMONIK YUA..........460
SOMOV VP...............407
SON EG............29, 277
SPEAR DM...............429
SPENCER FJ.............492
SPITZLEI H.............127
SPURGEON JC............600
STAMM W................583
STAPELFELDT JP....347, 546
STATEHAM RM............103
STAUFFER E.............514
STETSOVSKIY MP.........303
STEVENS AM.............661
STEVENS RE.............646
STEVENSON AE...........345
STEWART RD.............583
STEWART RS.............583
STICKNEY CW............189
STOLL AM...............130
STRATTON AK............645
STROUT RE..............474
STUCKEY RN..............53
STUDENTS AGAINST FIRE..437
SULLIVAN JL.......489, 490
SUPKIS DE..............433
SWARTZ J...............476
SWAYGE LJ..............344
SYLVIA R.....449, 450, 556

T

TAJIMA T...............409
TAKADA K...............585
TAKAHASHI S.......479, 480
TAMBLYN RT.............305
TAMURA GT..............222
TARADAYKO VP...........501
TATEM PA..........122, 510
TAYLOR AF...............48
TAYLOR AJ..............186
TAYLOR W...............146
TEWARSON A.............117
THEOBALD CR............526
THOMAS MW..............470
THOMAS PH...............74
THOMAS W JR............648
THORNE PF....526, 528, 529
THRASHER CL.......473, 557
TIMBY EA...............416
TIMOFEEV NV............502
TOMASIDES C............563
TOMS HL, JR............326
TOOR J.................211
TOVEY H......139, 142, 666
TROY JJ................401
TRUMBLE TM........232, 246
TSOUKALAS SN...........147
TSYMBAL VG.............352
TUBASHOV LK............319
TUCKER DM..........42, 529
TUGAYE J...............418
TURKOV AS..............303
TURNER R...............112
TWILT L......176, 212, 647
TYRRELL EA.............667

U

UDDIN T................271
UL'YANCHENKO NV........407
UMEZHAWA M.............304
URBACH R...............571
UTKINA ZH D.......463, 509

V

VAN ACKER A.............54
VAN DER WALT NT........379
VANSTEE EW........602, 603
VASIL'EV AD.......286, 287
VASIL'EV GA............589
VASILENKO VV............377
VAUGHAN F...............115
VELIK IP...............378
VERVALIN CH........21, 654
VESELOV AI........319, 501
VICKERS A..............142
VICKERS AK.........39, 139
VIETS H................326
VIGAR AD...............311
VIGLIN VE..............295
VIGNON J...............553
VINCENT J..............427
VISHNEVSKIY LD.........377
VOGT H.................163
VOLKOV MP...505, 506, 515,
VOLKOV MP (cont'd)
.....................516
VOLKOV OM..............402
VOORHEES KJ..158, 595, 598
VOSTRYAKOV VI.....504, 505

W

WAGNER JP.........228, 240
WAHLE K................325
WAIDE DC................62
WAKAMATSU T............102
WALKER WE...443, 445, 456,
....459, 561, 563, 565,
................566, 569
WALLHAGEN RE...........387
WALSH MP JR............205
WALSH RH...............416
WARITZ RS..............590
WARNER BL.........383, 386
WASHBURN AE............614
WATANABE H.............409
WATANABE Y.............551
WATERMAN TE............243
WATKINS TN..............96
WEATHERFORD WD JR......414
WEDEL GL...............111
WEINHEIMER JP..........242
WEISNER D..............365
WEITZMANN DO...........441
WELKER R...............240
WERTHENBACH HG....61, 109,
.....................208
WESTHOFF RP............281
WHYTE RB...............415
WIERSMA SJ...184, 213, 307
WIGHT DC...............429
WILLEY AE................47
WILLIAMS FA.............71
WILLIAMS FW............122
WILLIAMS RA............314
WILLIAMSON RB......65, 255
WILLIS CL...............648
WILTSHIRE LL......329, 531
WINER A................193
WINGER JH..............129
WINTERFELD G...........524
WITTEVEEN J.......176, 647
WOJCIK LH..............595
WONG F.................624
WONG JKS...............419
WOOLHEAD FE............659
WOOLLEY WD........144, 152
WRIGHT BR..............414
WRIGHT EE..............458
WULFF W........87, 93, 111
WYETH HWG..............425

Y

YAKOVLEV AI......252, 253,
................263, 396

AUTHOR INDEX

YAMADA E................321
YAROSH VA..............319
YOUNG ME...............483
YOUNG RA...............247
YUR'EV AP..............291

Z

ZACCARIA DE............130
ZACHARY WB.............400
ZBOROVSZKY Z...........282
ZENKOV NI..............174
ZIKRIA BA..............591
ZILE RH.................99
ZIMINA AF..............292
ZINN BT......147, 151, 159
ZITZMANN H.............391
ZOZULYA VM.............360
ZUCCARELLI LA..........541
ZUKOSKI EE..............70
ZUNDE P.................20
ZURINA GN..............269

SUBJECT INDEX

A

ACCIDENTS
(a s: aircraft accidents; explosions; ship accidents; traffic accidents)
chemical plants
  safety principles....365

ACOUSTIC BOARDS
ignition
  fire test methods....125

ACOUSTIC SOUNDING
meteorological factors
  forest fire control..104

ADDITIVES SEE: SLIPPERY WATER; SURFACTANTS; WETTING AGENTS

ADHESIVES
ceramic tiles
  fire behavior........115

AERIAL PLATFORMS SEE: ELEVATING PLATFORMS

AEROSOLS
protective mask
  patent...............482

AEROSPACE MATERIALS
fire resistance testing
  evaluation...........423

AGARD
Propulsion and Energetics Panel
  45th annual meeting..412

AGRICULTURE
fire prevention
  textbook.............360

AIR CYLINDERS SEE: GAS CYLINDERS

AIR DUCTS
(a s: ventilation systems)
fire dampers...........322
sealing gaskets
  mines................377

AIR FORCE BASES
warehouses
  sprinkler evaluation.......................335

AIRCRAFT
compartments
  fire tests...........185
fire protection
  halon 1301...........332
fuel tanks
  nitrogen inerting....182

AIRCRAFT ACCIDENTS
(a s: accidents)
fire losses
  US 1963-1974..........37
fuel fires
  UK 1955-1974..........48

AIRCRAFT CARRIERS
deck aircraft crashes
  fire protective clothing..................130

AIRCRAFT CRASH FIRES
(a s: aircraft fires; aircraft ground fires)
cost analyses
  US 1963-1974..........37
dynamics
  ignition and spread...86
research
  UK....................25
suppression
  review...............523
suppression systems
  airborne.............328

AIRCRAFT CRASHES SEE: AIRCRAFT ACCIDENTS

AIRCRAFT ENGINES
bay fires
  detection and suppression.............427

AIRCRAFT FIRE SAFETY
AGARD meeting
  1975.................412
fire protection
  engine bays..........427
  status...............426
fuel systems
  fire protection......425
survey
  USSR.................402

AIRCRAFT FIRES
(a s: aircraft crash fires; aircraft ground fires)
cabins
  precrash fires........49
engine bays
  detection............427
extinguishants
  tests................522

AIRCRAFT FIRES (cont'd)
fire resistance
  fiber systems........169
hangar decks
  foam sprinklers......329
interior materials
  combustion products..153
parachutes
  fire resistance......169
precrash
  washrooms.............50
suppression
  foam generators......326
  rockets..............559

AIRCRAFT FUEL FIRES
(a s: fuel fires)
cascade
  extinguishants.......531
death ratio
  review................48
dynamics
  ignition and spread...86
halons
  extinguishment mechanism..................330
pool
  extinguishants.......531

AIRCRAFT GROUND FIRES
fuels
  suppression..........532
suppression
  airfield parameter study..................327
  dry chemicals........531

AIRCRAFT HANGARS
fire protection
  foam extinguishants..333

AIRCRAFT INTERIORS
finishing materials
  combustion products..................153, 424
  toxicity ranking.....600
fire protection
  Halon 1301...........428
materials
  electrical overheating....................119
  fire retarded........433
  flammability.........421
polymers
  fire dynamics........422
precrash fires
  analysis..............49
seat cushions
  fire-resistant foams.......................283
washroom fires
  intoxication fatalities....................50

SUBJECT INDEX

AIRCRAFT MATERIALS
fire resistance
development and evaluation...............53
polyamide fabrics
decomposition products..
..................154

AIRCRAFT REFUELING
explosion hazard
tank vents...........419

ALCOHOLS
flammability limits
premixed and diffusion
flames.............88

ALKANES
flammability limits
premixed and diffusion
flames.............88

ALUMINUM STRUCTURES
fire endurance
small-scale tests....193

AMBULANCE PERSONNEL
emergency medical services
training course......609

AMERICAN INSURANCE ASSOCIATION
Fire Prevention Code
1976 edition.........631
National Building Code
1976 edition.........629

ANECHOIC CHAMBERS
foamed materials
electrical ignition...35
fire performance tests..
..................122

ANESTHETICS
fire hazards
operating rooms.......30

ANIMAL EXPERIMENTS
combustion products
toxicity.............604
fire gases
bioassay.............149
paint combustion products
toxicity.............593
rats
combustion toxicology...
..................598
toxicity ranking
laboratory experiments..
..................600

ANTIMONY OXIDE
fire retardant
polypropylene........113

APPARATUS
crew composition
USSR.................439
elevating platforms
cost/benefits........463
emergency lights.......464
configurations.......464
fire trucks
turret controls......469
low ground pressure
polar regions........470
maintenance
procedures...........471

APPAREL SEE: CLOTHING

APPLIANCES (VEHICLES) SEE: APPARATUS

ARCHITECTS
fire safety education
National Fire Academy
conference........542

ARSON
(a s: incendiarism)
detection
task force...........580
hydrocarbon processing plants
investigation routine...
..................581
law enforcement........582
task force...........580
threat evaluation
review...............579
unfinished buildings....33

ARSON INVESTIGATION
methods
book.................578
hydrocarbon processing
plants............581
task force.............580

ASTM STANDARDS
E-119
theoretical analysis....
..................196

ATLASES
forest fires
United States........342

ATOMIZATION
liquids
patent...............319

AUSTRIA
forest fires
risk calculation.....650

AUTOIGNITION
propane-halon mixture..118

AUTOMATIC CONTROL SYSTEMS
fire protection
suitability..........536

AVIATION FUELS
comparison
flammability.........132
ignition.............132
fire resistance
antimist.............414
polymeric additives..413
research program.....413
fire resistant
systems problems.....416
ignition properties
summary...............91
JP-4
fire safety..........429
JP-5
flammability properties.
..................132
JP-8
fire safety..........429
kerosine
fire safety..........415
polymeric antimist
research.............414
wide-cut
fire safety..........415

B

BACKDRAFT
structural causes
prediction............62

BAPTIST TOWERS FIRE
Atlanta, GA
review................43

BEDDING
(a s: blankets; mattresses)

BEHAVIOR SEE: HUMAN BEHAVIOR; FIRE BEHAVIOR

BELGIUM
fire research programs
building construction...
..................54

BERYLLIUM
fire behavior..........155

BIBLIOGRAPHIES
burn care
planning and development
..................612
Fire Res Notes
1974..................16
fire research
civil defense.........15

SUBJECT INDEX

BIBLIOGRAPHIES (cont'd)
fire research (cont'd)
  NBS....................14
  RANN-sponsored........13
hazardous materials
  transportation.......641
mine fires.............385
protective clothing....483
spontaneous combustion
  solid materials......134

BIO-PAK 45
breathing apparatus
  Navy.................484

BLANKETS
(a s: bedding)
fire hazards
  analysis.............139

BOY SCOUTS OF AMERICA
Firematics Exploring
  fire department youth
    program...........540

BREATHING APPARATUS
(a s: respirators)
communication system
  speech amplifiers....484
compressed air.........490
  lightweight..........489
demand-type
  firefighting operations. 478
instruction book.......478
oxygen generation
  design and performance.. 480
  potassium superoxide.... 479
smoke divers
  training program.....454
suitability tests
  rescue services......608

BRIGADES
industrial
  organization and training................371

BROWNS FERRY FIRE
fire prevention
  recommendations......392

BUDGETING
fire departments
  New York City........444

BUILDERS
fire safety education
  National Fire Academy
    conference........542

BUILDING CODES
American Insurance Association
  1976 edition.........629
building officials
  fire tests...........205
concrete construction
  fire resistance......171
Europe
  fire tests...........194
fire endurance tests....65
highrise buildings
  restrictive aspects..397
legal aspects
  drafting procedures..632
national
  1976 edition.........629
precast concrete
  fire rating..........260
regulatory process.....634
technical aspects
  drafting procedures..632
USSR
  development principles.. 218

BUILDING COMPONENTS
fire test standardization
  Europe...............194

BUILDING CONSTRUCTION
fire research programs
  Belgium...............54
fire safety
  code development.....218

BUILDING DESIGN
concrete structures
  fire resistance......171
fire safety
  conference.............7
highrise buildings
  fire protection principles..............219
structural protection
  fire spread..........224

BUILDING FIRES SEE: STRUCTURAL FIRES

BUILDING MATERIALS
chemicals
  fire tests...........127
fiberboards
  fire safety..........116
fire protection
  testing..............191

BUILDING OFFICIALS
fire tests
  codes................205

BUILDING REGULATIONS
fire tests
  standardization......194

BUILDING RESPONSE
explosions
  loading level.........41

BUILDING STRUCTURES
combustibility classification
  methodology..........270
compartment fires
  measurement..........120
fire buildup
  flame spread..........68
  stochastic model.....209
fire protection
  economics............265
  testing..............191
fire resistance
  computer calculation.... 269
  testing..............261
unfinished
  fire hazards..........33

BULKHEADS
ship fires
  heat transfer........405

BURN CARE
medical facilities
  New Jersey...........611
  Pennsylvania.........612

BURN HAZARD
measurements
  thermesthesiometer...616

BURN INJURIES
clothing fires
  estimation...........619
  severity.............617
fabrics
  ignition probability..93
  potential............624
respiratory
  clinical diagnosis...591

BUS ACCIDENTS SEE: TRAFFIC ACCIDENTS

BUS FIRES
traffic accidents
  investigation.........38

BUSES
seat cushions
  fire tests...........183

C

CABARETS SEE: NIGHTCLUBS

CABLE DUCTS SEE: ELECTRICAL DUCTS

CABLES SEE: ELECTRICAL CABLES

CARBON DIOXIDE LASERS
surgical use
  fire hazards..........28

CARBON MICROSPHERES
extinguishants
  nuclear fires........511

CARBON MONOXIDE
breath analyzer
  carboxyhemoglobin
    estimation........583
poisoning
  clinical diagnosis...591
polymers
  measurement..........156

CARBON MONOXIDE EXPOSURE
firefighters
  carboxyhemoglobin....583
smoke inhalation.......588

CARBOXYHEMOGLOBIN
firefighters
  carbon monoxide exposure
    ....583, 610

CARDIAC CARE
emergency
  textbook.............605

CARDIOPULMONARY RESUSCITATION
emergency medical care
  principles...........606
textbook...............605

CARPETS SEE: FLOOR COVERINGS

CASCADE FIRES
aircraft fuels
  dry chemical extinguishants..............531

CASUALTY EXTRICATION
emergency medical care
  textbook.............607

CASUALTY HANDLING
emergency medical care
  textbook.............607

CATALYTIC HEATERS
ignition hazards........90

CEILING PANELS
fire buildup
  corner tests..........68

CELLULOSE FABRICS
flame interaction
  preignition processes.....................111

CELLULOSE-POLYAMIDE MIXTURES
thermal behavior
  analysis.............112

CELLULOSIC FIRES
extinguishants
  nitrogen.............510

CELLULOSICS
fire buildup............94
flame retardants
  evaluation mechanism.......................167
pyrolysis
  dynamics.............121

CERAMIC TILES
floor coverings
  fire resistance......115
wall coverings
  fire resistance......115

CERTIFICATION
fire test laboratories
  UK....................56

CHASES
gypsum boards
  fire endurance.......145

CHEMICAL FIRES
solid materials
  surfactant extinguishants.............501

CHEMICAL INDUSTRY
accident prevention
  principles...........365
loss prevention
  hazards identification.....................635
processing equipment
  fire prevention......370

CHEMICALS
fire hazards
  survey...............137

CIVIL DEFENSE
fire research
  bibliography..........15

CIVIL DEFENSE (cont'd)
fire threat
  nuclear explosions...213

CLIFTON, NJ
fire/police consolidation.
 2

CLOTHING
(a s: protective clothing; sleepwear)
fire hazards
  parameters...........142
flame resistance
  finishes.............168
  ranking tests........161
  standards............166
flammability tests
  proposed standard....645

CLOTHING FIRES
burn injuries
  estimation...........619
  human behavior.......617

COAL AUGERS
fire protection system
  tests................384

COAL DUST
explosions
  extinguishment.......389
flammability
  ignition temperature..82

COAL MINES
conveyor belts
  fire suppression.....386
explosions
  physical description.......................390

COAL-OIL FIRES
mines
  foam application rates.....................518

CODES
(a s: building codes; fire codes)
emergency lighting
  United Kingdom.......633
international..........191

COMBUSTIBILITY CLASSIFICATION
building structures
  methodology..........270

COMBUSTIBLE LIQUIDS
aviation fuels
  ignition properties...91
storage
  safe handling........661

SUBJECT INDEX

COMBUSTIBLE MATERIALS
fire safety
  international symposium. 6

COMBUSTION PRODUCTS
analysis
  methodology..........158
animal experiments
  toxicity.............604
inhalation toxicity
  assessment...........594
paints
  toxicity.............593
plastics
  fire damage..........251
  toxicity.............152
polymers
  toxicity...589, 590, 592
polyurethane foams
  fire retarded........595
sampling and analysis..626
smoldering fires
  irritants............586
subway cars
  toxicological hazards... 601
toxicity and physiology
  symposium.............11

COMBUSTION TOXICOLOGY
bicyclophosphate
  retarded urethane foams. 595
hypoxia
  preventive measures..588
local irritants
  preventive measures..588
polymers
  smoke................597
polyurethane foams
  rats.................598
polyvinylchloride
  firefighters.........596
systemic poisons
  preventive measures..588
testing methods........599

COMMERCIAL BUILDINGS
fire loads
  survey program.......257

COMMERCIAL STANDARDS
voluntary
  status and prospects.... 646

COMMUNICATIONS CENTERS
fire operations
  computer control.....496
telephone line requirements
  calculation.........495

COMMUNICATIONS (cont'd)
urban fire protection
  line requirements....495

COMMUNICATIONS INDUSTRY
combustible materials
  flammability tests...372

COMMUNICATIONS SYSTEMS
fire departments
  equipment............493
  future expansion.....494
  Houston, TX.....493, 494
information processing
  fire departments.....441

COMPARTMENTS
fire behavior
  flashover........74, 215
  measurement..........120
fire buildup
  early stages..........67
  evaluation............76
  small-scale tests....210
  tests.................75
fire resistance
  post-flashover........65
fire severity
  simulation...........256
fire spread
  convective flows......70
fire tests
  description and data.... 199
  full-scale...........204
  hazard prediction....201
ship fires
  heat transfer........405

COMPF
computer program
  fire temperature calculation...........66

COMPRESSORS
oxygen
  fire safety..........368

COMPUTER PROGRAMS
COMPF
  fire temperature calculation...........66
fire company allocation
  parametric model.....572
fire hazard evaluation
  electrical circuits..282
fire load analysis
  national survey.......58
fire protection resources
  real-time relocation.... 568
response parameters
  emergency vehicles...574

COMPUTER PROGRAMS (cont'd)
steel beams
  fire stability.......176

COMPUTER ROOMS
fire safety
  guidelines...........350

CONCRETE STRUCTURES
beams
  fire behavior........212
fire behavior..........271
fire resistance
  book.................171
  parameters...........172
heat loads
  computer calculation.... 253
hollow-core
  fire tests...........190
precast
  fire protection......260
reinforced
  fire behavior........175
  fire endurance.......173
  temperature fields...262
wall panels
  fire tests......252, 254

CONFERENCES
Arson and Incendiarism
  1975.................579
Cellulose
  1975.................112
Designing for Fire Safety
  1976...................7
Fire Prevention
  NFPCA 1976 announcement. 10
Fire Protection
  Apr/May 1975.....8, 219, ...273
Fire Safety Education and Training
  1976.................542
Flammability of Materials
  1975.................147
Foams and Wetting Agents
  1974......285, 286, 287, ..288, 339, 373, 374, ..375, 376, 497, 498, ..499, 500, 501, 502, ..503, 504, 505, 506, ...507, 508, 509
Heat Transfer
  1975.................111
Professional Development
  1975...................1
Space Simulation
  1975..................53
Wool Textile Research
  1975..................77

SUBJECT INDEX

CONGRESSES
Gas
1975..................180
Precast Concrete Industry
1975.............54, 260

CONSOLIDATION
fire/police
analysis............2, 3

CONSTRUCTION SITES
fire prevention
control and inspection....................278

CONSUMER PRODUCT SAFETY COMMISSION
accident information data system..............648

CONSUMER PRODUCTS
standards
drafting reforms......643
fire safety...........648

CONVECTIVE FLOWS
compartment fires
modeling...............70

CONVEYOR BELTS
coal mines
fire suppression......386
mines
foam protection......375

CORRESPONDENCE COURSES
fire service
London (UK)..........451

CORRIDOR FIRES
floor coverings
fire spread.......69, 73
full-scale tests.....195

CORROSION DAMAGE
combustion products
plastics..............251

COTTON
fire hazards
identification.......636
fire tests
photoelectric smoke detectors.........235

CURTAINS SEE: SMOKE CURTAINS; WATER CURTAINS; WINDOW COVERINGS

CYLINDERS SEE: GAS CYLINDERS

D

DAMAGE ECONOMICS
residential
evaluation...........656

DAMAGE REDUCTION
construction sites
control and inspection....................278

DANCE HALLS
(a s: nightclubs)
fire incidents
human behavior.......348
fire protection
controls.............347

DATA ANALYSIS
fire loads
national survey.......58

DATA BASES
fire literature
availability..........20
Nat Fire Data Center
mission................4

DATA CODING
report system
FIRES-2..............473

DATA PROCESSING
fire departments
management...........477
fire operations
command and control..537

DETECTION SYSTEMS
false alarms
causes...............239
fire
early warning........226
fail-safe............229
performance..........239
selection criteria...226
mine fires
haulage vehicles.....336
mine gases
recommendations......240
research
Fire Res Station (UK).....................245
smoke
spacecraft...........246
sprinklers
performance..........247

DETECTORS SEE: FIRE DETECTORS; FLAME DETECTORS; INFRARED DETECTORS; IONIZATION DETECTORS; SMOKE DETECTORS; ULTRAVIOLET DETECTORS

DIESEL GENERATORS
shipboard
foam effects.........357

DIRECTORIES
fire protection
product listings......18

DISASTER MANAGEMENT
emergency medical care
casualty extrication.......................607
casualty handling....607

DISCOTHEQUES SEE: DANCE HALLS

DISPATCHING
fire department policy
analysis.............573
unit availability....571
management information system
specifications.......475

DISPERSED-GAS SYSTEMS
combustion and explosion
preventive measures..267

DOWNWALLS
mines
fire-hazard zones....378

DRAPES SEE: WINDOW COVERINGS

DRY CHEMICALS
application
aircraft ground fires.....................531

DRY POWDER
development
field trials.........529
discharge patterns
fixed installation...296
dispenser
rocket motor type....531
extinguisher
charging patent......312
extinguishing efficiency
testing methods......525
fire extinguishing
mines................517

DUCTS SEE: AIR DUCTS; ELECTRICAL DUCTS; VENTILATION SYSTEMS

SUBJECT INDEX

DUST
combustion and explosion
preventive measures..267
protective mask
patent...............482

DUST EXPLOSIONS
hazard reduction
safety systems.......274

DUST FIRES
hazard reduction
safety systems.......274

DUST SUPPRESSION
fog nozzles
remote control.......295

E

EARTHQUAKES
fire protection
Japan................207
vehicles
fire safety..........410

EDUCATION
(a s: correspondence
courses; fire safety
education; fire safety
training; fire science
education; fire service
instructors; National
Fire Academy; public
education; training)

ELECTRICAL CABLES
(a s: electrical circuits;
electrical wiring)
ducts
ignition temperature..80
insulation
fire retardation.....355
flame retardant......358
smokeless............359

ELECTRICAL CIRCUITS
(a s: electrical cables;
electrical wiring)
fire hazards
computer evaluation..282

ELECTRICAL COMPONENTS
flammability
quality control......372

ELECTRICAL DUCTS
insulation
ignition temperature..80
power plants
fire protection......352

ELECTRICAL EQUIPMENT
explosion protection
new developments.....356
fire hazard
safety regulations...354
flame arresters
arc containment......280

ELECTRICAL FIRES
hazards
transit cars.........435
hospitals
operating rooms......249
statistics
USSR.................662

ELECTRICAL INJURIES
hospitals
operating rooms......249

ELECTRICAL INSULATION
cables
flame retardant......358
ignition temperature..80

ELECTRICAL WIRING
(a s: electrical cables;
electrical circuits)
fire hazards
National Electric Code..
..................353

ELECTRONIC ASSEMBLIES
fire hazards...........140

ELEVATING PLATFORMS
fire departments
cost/benefits........463

ELEVATOR SHAFTS
pressurization
testing..............303

ELEVATORS
fire protection
highrise buildings...225

EMERGENCY LIGHTING
code of practice
United Kingdom.......633

EMERGENCY LIGHTS
apparatus
configurations.......464

EMERGENCY MEDICAL CARE
cardiovascular system
principles...........606
casualty extrication
techniques...........607
casualty handling
techniques...........607
paramedics
textbook.............605

EMERGENCY MEDICAL (cont'd)
respiratory system
principles...........606

EMERGENCY MEDICAL SERVICES
ambulance personnel
training course......609

EMERGENCY SERVICES
deployment
training course......456
response districts
mathematical model..575,
..............576, 577
vehicles
response parameters..574

ENGINE FACTORIES
fire safety
loss reduction.......363

ESCAPE MEANS
(a s: evacuation devices)
fire situations
code of practice.....630
highrise buildings
patent...............553
portable
patent...............467

ESCAPE ROUTES
(a s: evacuation methods)
evacuation studies
West Germany.........550
smoke movement
control measures......97

EUROPE
fire tests
standardization......194

EVACUATION DENSITIES
rescue operations
test results.........546

EVACUATION DEVICES
(a s: escape means)
chutes
development...........55
highrise buildings
patent...............553
slides
offshore platforms...552

EVACUATION METHODS
(a s: escape routes)
smoke obscuration
voice guidance.......551

EVACUATION PROBLEMS
highrise buildings
fires................547

SUBJECT INDEX

EVACUATION STUDIES
escape routes
  West Germany.........550

EVACUATION TIMES
rescue operations
  test results.........546

EXITS
evacuation rates
  test results.........546

EXPLOSION HAZARDS
fluorenes
  determination........136
kinetic criteria
  fuel-air mixtures.....85
rubber foam
  storage..............144
ship compartments
  classification.......637
thermochemical criteria
  fuel-air mixtures.....85

EXPLOSION PROTECTION
electrical equipment
  new developments.....356
hazardous atmospheres
  guidelines...........248

EXPLOSIONS
accidental
  building response.....41
coal dust
  extinguishment.......389
venting................100

EXPLOSIVE ATMOSPHERES
hazard avoidance
  guidelines...........248

EXTINCTION LIMITS
alcohol flames
  premixed and diffusion.. 88
alkane flames
  premixed and diffusion.. 88

EXTINCTION PHENOMENA
flammable liquids
  thermal theory........95

EXTINGUISHANTS
(a s: dry powder; foam
  extinguishants; halons)
aircraft fuel fires
  tests................522
carbon microspheres
  nuclear fires........511
foams
  application rates....338
  performance..........333
  water-air interactions..

EXTINGUISHANTS (cont'd)
foams (cont'd)
  water-air (cont'd) 527
halon 1301
  dispenser............305
inert gases
  mine fires...........388
methyl bromide
  aircraft fuel fires..330
nitrogen
  confined spaces......510
steam
  petrochemical industry.. 520
surfactants
  chemical fires.......501
toluene diisocyanate fires 514
toxicity
  environmental hazards... 603
  review...............602
trifluorobromomethane
  aircraft fuel fires..330
twin agents
  portable extinguisher... 300
viscous water
  sodium carboxymethylcellulose............513
  test results.........512

F

FABRIC FIRES
extinguishants
  nitrogen.............510

FABRICS
aluminized
  firefighter clothing.... 487
cellulose
  flame interaction....111
cotton/polyester
  flame resistant......160
fire hazard
  assessment...........138
fire protection
  survey...............165
fire resistant
  firefighter clothing.... 487
flame resistant
  solubilities.........160
flammability...........142
  burn injuries........624
  char length...........81
flammability tests
  development status...129
ignitability
  measurement...........81

FABRICS (cont'd)
ignition probability....93
nylon-wool
  flammability behavior... 77
polyamides
  decomposition products.. 154
polyester-wool
  flammability behavior... 77
polymers
  fire hazards.........135
pyrolysis products
  toxicity testing.....599
radiative ignition
  prediction............87

FALSE ALARMING
detection systems
  causes..........239, 240
flame detectors........244

FALSE ALARMS
incidents..............582

FATAL FIRES
aircraft
  toxic products........50
Baptist Towers
  review................43
highrise buildings
  New York City.........44
mobile homes
  incident..............45
prisons
  Florida...............22
  Pennsylvania..........23
tanker ships
  New York Harbor 1973..40

FATALITIES SEE: FATAL
  FIRES; FIRE FATALITIES

FFACTS
blankets
  fire hazards.........139
data base
  clothing fires.......617
  Nat Bureau of Standards. 142

FIBER SYSTEMS
multicomponent
  flammability..........84
parachutes
  fire resistance......169

FIBERBOARDS
building materials
  fire safety..........116
fire-resistant
  processing methods...162

FIBERGLASS
floor coverings
  shipboard............131

FIBROUS MATERIALS
thermal characteristics
  analysis.............114

FILTERS
electrostatic
  smoke removal....55, 304

FINISHES
nonflammable
  clothing.............168

FINISHING MATERIALS
aircraft interiors
  combustion products..424
ship corridors
  flame spread..........63

FIRE ACADEMY
Nat Fire Prevention and Control Admin
  site selection.......457

FIRE ANALYSES
highrise buildings
  unfinished............33
plastics plant
  insurance............660
vehicle fires..........665
  West Germany..........34

FIRE ATMOSPHERES
chemical composition
  sampling and analysis.....................626

FIRE BAFFLES
air ducts..............322

FIRE BEHAVIOR
adhesives
  ceramic tiles........115
building contents......255
cellulose-polyamide mixtures...............112
compartments
  flashover.............74
  measurement..........120
fire tests
  full-scale...........206
floor coverings
  testing methods......192

FIRE BUILDUP
building structures
  stochastic model.....209
compartments
  early stages..........67
  evaluation............76
  mathematical model....75

FIRE BUILDUP (cont'd)
compartments (cont'd)
  small-scale tests....210
gas concentration
  measurement...........92
high-rack warehouses....32
interior finishes
  corner tests..........68
nuclear explosions
  thermal radiation....106
residential occupancies
  thermal radiation....106
tank fires
  parameters............61

FIRE CAUSES
aircraft fuel tanks
  ignition proofing....417
investigation
  fire tests...........189
smoking
  UK 1965-1974..........26

FIRE CHIEFS
leadership qualities...538

FIRE CODES
(a s: building codes)
American Insurance Association
  1976 edition.........631
escape means
  fire situations......630
national
  American Insurance Association.......631
regulatory process.....634
transit systems
  development..........401

FIRE COMPANIES
allocation
  decision model.......562
  parametric model....564, ...570, 572
deployment
  evaluation model.....565
  performance evaluation.....................573
  simulation...........563
personnel
  crew composition.....560
relocation
  computer programs....568
travel time
  model................567

FIRE DAMAGE
plastics
  corrosive effects....251
UK
  comparison...........652

FIRE DATA BASE
Lawrence Livermore Lab
  user's manual........474

FIRE DEATHS SEE: FIRE FATALITIES

FIRE DEPARTMENTS
Boy Scouts
  youth programs.......540
communications systems
  equipment............493
  future expansion.....494
  Houston, TX.....493, 494
  information processing.....................441
deployment
  performance evaluation...............569, 573
  student's manual.....459
  training course......459
emergency medical care
  textbook.............605
expenditures
  New York City........444
management
  information systems.....
  ...472, 473, 475, 477
management planning
  allocation models...570, ...572
operations
  deployment policy....571
  simulation...........563
  systems analysis.....445
performance
  analysis.............569
  New York City........443
recovery teams
  scuba training.......452
reporting forms
  number of rescues....476
rescue teams
  scuba training.......452
response districts
  mathematical model..575, ...576, 577
response parameters
  travel time..........574
scheduling
  student's manual.....459
  training course......459
statistics
  Germany 1975.........663
youth programs
  firematics exploring.....................540

FIRE DETECTION
automatic
  systems engineering..231
mines
  new techniques.......379

FIRE DETECTORS
(a s: detectors)
early warning
  reliability..........226
high temperature
  electronic circuits..234
  infrared.............234
  ultraviolet..........234
infrared
  methane-air ignitions.....................241
mobile homes
  placement............238
optical radiation
  polymeric pyroelectric sensors...........233
residential
  Taguchi..............331
Taguchi
  testing..............331

FIRE DYNAMICS
aircraft crashes........86

FIRE ENDURANCE
(a s: fire resistance)
aluminum structures
  small-scale tests....193
compartments
  building codes........65
concrete structures
  computer calculation.....................253
concrete wall panels
  joints...............254
  tests................252
gypsum boards
  testing..............145
reinforced concrete
  calculation..........173
ship decks
  calculation..........406
ship structures
  time-temperature curve.....................268
steel columns
  temperature histories.....................259

FIRE ENVIRONMENTS
human behavior
  research possibilities.....................628
physiological response
  thermal stresses.....625

FIRE ESCAPES
chute
  development...........55

FIRE EXPOSURE
toxicological aspects
  assessment...........594

FIRE EXTINGUISHANTS SEE: EXTINGUISHANTS

FIRE EXTINGUISHERS
automatic
  foam proportioners...286
dry powder
  charging patent......312
  fixed................296
failures...............306
first aid
  types................299
fixed
  discharge head.......323
  operational reliability...................293
  varnish and paint factories............297
foam distributor
  walled containers....309
fuel storage tanks
  patent...............309
patent
  USSR.................318
portable
  mine fires...........291
pressurized gas
  patent...............314
storage cabinets
  patent...............315
twin agents
  description..........300

FIRE EXTINGUISHMENT
automatic control
  systems engineering..231
mechanical foam
  developments.........521

FIRE FATALITIES
aircraft accidents
  UK 1955-1974..........48
  US 1963-1974..........37
causes
  statistical analysis.....................615
firefighters
  causes...............614
  statistics...........618
Maryland
  analysis.............620
scenarios
  firesafety planning..613
ship collisions
  New York harbor.......40

FIRE FLOWS
(a s: water supplies)
highrise buildings
  tactics..............533
mathematical calculations
  firefighting tactics.....................557

FIRE GASES
buildup
  measurement...........92
characterization
  apparatus and methodology...............149
flow velocity
  measurement..........101
hydrochloric acid
  corrosive effects....148
physiological effects
  toxicity.............587
recirculation extinguishment method
  ship fires...........530
sampling and analysis..626
thermal behavior
  measurement..........101

FIRE HAZARDS
anesthetics
  hospitals.............30
blankets
  analysis.............139
buildings and structures
  standards............250
chemicals
  survey...............137
cotton
  identification.......636
electrical
  operating rooms......249
electrical circuits
  computer evaluation..282
electrical equipment
  safety regulations...354
electrical wiring
  National Electric Code.....................353
electronic components..140
fabrics
  assessment...........138
  clothing.............142
fluorenes
  determination........136
furnished rooms
  plastics.............146
highrise buildings
  unfinished............33
hotels
  human behavior.......346
  protection measures..346
incendiarism
  threat evaluation....579
laser surgery
  larynx and trachea....28
mines
  downwalls............378
mobile homes
  tests................181
plastics
  furniture and furnishings..............146

FIRE HAZARDS (cont'd)
polymers
  fabrics..............135
  industrial evaluation......................590
  test methods..........117
  vehicles.............435
processing equipment
  chemical plants......370
protective clothing
  firefighters.........481
quantification.........666
ship compartments
  classification.......637
subway car interiors
  evaluation...........432
systems behavior
  testing..............217
vehicles
  fuel leakage.........143
window coverings
  survey...............39

FIRE HOSES
specifications
  survey...............468

FIRE INCIDENTS
demographic variables
  medical effects......620
hazardous materials
  injuries.............667
highrise buildings
  Atlanta, Ga...........43
  evacuation problems..547
  New Orleans...........46
  New York City.........44
  Squibb Building......547
  World Trade Center...24, ...547
hospitals
  operating rooms.......27
investigations
  research significance.....................47
mobile homes
  Michigan..............45
prisons
  Florida...............22
  Pennsylvania..........23
recreation buildings
  UK 1965-1974..........26
reporting systems
  analysis.............666
schools
  building performance..42
  fire development......42
Squibb Building
  evacuation problems..547
tanker collisions
  report................40
UK 1965-1974
  survey................26

FIRE INCIDENTS (cont'd)
warehouses
  USSR 1974-1975........29
window coverings
  survey................39
World Trade Center
  evacuation problems71-
    fire incidents....547

FIRE INJURIES
smoke inhalation
  respiratory complications..............584

FIRE INVESTIGATION
methods
  book.................578

FIRE LITERATURE
data bases
  availability..........20
key references..........21

FIRE LOADS
building contents
  fire behavior........255
calculation
  mathematical model...258
commercial buildings
  survey program.......257
compartments
  simulation...........256
living quarters
  ocean vessels........407
office buildings
  surveys..............258
paper
  analyses.............133
plastics
  hazards identification.....................24
survey
  data analysis.........58

FIRE LOSSES
(a s: large loss fires; property losses)
aircraft accidents
  cost analyses.........37
arson
  incidents............582
calculation method
  USSR.................653
forest fires
  appraisal............655
petroleum industry
  US...................654
residences
  urban poor...........651
statistics
  UK 1974..............664

FIRE MANAGEMENT
LANDSAT
  data collection platform..................344

FIRE OPERATIONS
command and control
  computer assisted....537
communications centers
  computer control.....496
firefighter monitoring
  physical condition...610
leadership aspects.....538

FIRE PERFORMANCE
building structures
  full-scale fires......47
fibrous materials
  analysis.............114
floor coverings
  testing methods......192
polyurethane foams
  carbon impregnated...122

FIRE/POLICE CONSOLIDATION
organization
  negative aspects.......3
  positive aspects.......2

FIRE PREVENTION
agriculture
  text book............360
building design........276
codes
  1976 edition.........631
conference
  1976..................10
construction sites
  control and inspection...................278
duty assignments
  firefighters.........440
fuel storage tanks
  automatic gauging....361
industry
  textbook.............360
insurance companies
  role.................649
mines
  bibliography.........385
  oxy-cement sealant...380
nuclear power plants
  reactor safety.......392
rail transportation
  mathematical model...436
research
  standards and specifications..............59
safety matchbooks
  child-resistant......275
time schedule analysis
  USSR.................277
vehicle accidents......266

FIRE PROTECTION
- air force bases
  - warehouses...........335
- aircraft
  - engine bays..........427
  - Halon 1301...........428
  - halon system.........332
  - status...............426
- aluminum structures
  - small-scale tests....193
- automatic control systems
  - suitability..........536
- building design
  - fire spread..........224
  - risk limitation......276
- building structures
  - economics............265
- buildings
  - maintenance program....8
- coal mines
  - augers...............384
- dance halls
  - controls.............347
- detection and warning
  - risk limitation......276
- directory
  - product listings......18
- elevators
  - highrise buildings...225
- engineering topics
  - survey................57
- fabrics
  - survey...............165
- fire baffles
  - air ducts............322
- flammable liquids
  - water sprays.........334
- foam extinguishants
  - aircraft hangars.....333
- gold mines
  - detection and alarm systems...........379
- handbooks
  - National Fire Protection Association........17
- highrise buildings
  - design principles....219
  - France...............349
- hotels
  - life safety..........346
- industrial
  - organization of brigades 371
- insurance companies
  - role.................649
- libraries
  - risk management......394
- mining
  - haulage vehicles.....336
- nightclubs
  - controls.............347
- organization
  - fire/police consolidation.............2, 3

FIRE PROTECTION (cont'd)
- organization (cont'd)
  - safety professionals...1
- power plants
  - cable ducts..........352
  - design...............391
- precast concrete
  - heat load effects....260
- printing ink factories
  - system selection criteria..........366
- risk level
  - USSR estimate........658
- sheath systems
  - sandwich configuration.. 272
- ships
  - study................430
  - USSR.................403
- shopping centers
  - Germamy..............351
- smoke detectors
  - residential..........243
- specialist training
  - mathematical model...453
- sprinkler heads
  - water distribution...325
- sprinklers
  - residential..........337
- steel structures
  - buildings............396
  - water filled.........220
- symposia
  - CTIF...................9
- transit systems
  - codes................401
- wool processing plant..369

FIRE PUMPS
- automatic control
  - patent...............320

FIRE REGULATIONS
- policy formulation
  - United Kingdom........52

FIRE RESEARCH
- Belgium
  - building construction... 54
- bibliographies
  - DCPA (civil defense)..15
  - Fire Res Notes........16
  - NBS...................14
  - RANN..................13
- cooperative
  - compartment fires.....67
- fire protection
  - survey................57
- full-scale fires
  - building structure performance...........47
- Japan
  - Tokyo Fire Science Lab..

FIRE RESEARCH (cont'd)
- Japan (cont'd)
  - Tokyo Fire (cont'd) 55
- US
  - status report.........60
- wind tunnels
  - design...............214

FIRE RESEARCH NOTES
- bibliography
  - 1974..................16

FIRE RESEARCHES
- Nat Bureau of Standards
  - programs 1976.........59

FIRE RESISTANCE
(a s: fire endurance)
- aerospace materials
  - testing..............423
- aircraft materials
  - development and evaluation...............53
- aviation fuels
  - polymeric antimist...414
  - research program.....413
  - systems problems.....416
- building structures
  - computer calculation.... 269
  - testing..............261
- buildings
  - ASTM Standard E-119..196
- compartments
  - post-flashover........65
- concrete structures
  - book.................171
  - parameters...........172
- fiberboards
  - processing methods...162
- floor coverings
  - ceramic tiles........115
- furnaces...............187
- parachutes
  - analytical study.....169
- steel beams
  - tests......177, 178, 179
  - theory...............176
- structural elements
  - residential buildings... 145
  - review...............264
  - test summaries.......198
- tank trucks
  - testing..............186
- tests
  - Japan................207
- wall coverings
  - ceramic tiles........115
- wall panels............263

FIRE RETARDANTS
floor coverings
  evaluation....170
polypropylene
  mechanical properties....113
wood
  sodium silicate films....163
wood roofs
  evaluation....170

FIRE RETARDATION
electrical cables
  polyvinylchloride
    insulation....355
fabrics
  survey....165

FIRE RETARDED MATERIALS
aircraft interiors
  durability....433

FIRE RISKS
(a s: risk management)
forests
  calculation....650
libraries
  management....394
unfinished buildings....33

FIRE SAFETY
aircraft
  survey....402
aviation fuels
  JP-4....429
  JP-8....429
building construction
  code development....218
building design
  conference....7
building materials
  fiberboards....116
combustible materials
  international symposium....6
compressors
  developmental trends....368
computers
  guidelines....350
electrical equipment
  regulations....354
engine factories
  loss reduction....363
flammable liquids
  industrial occupancies....362
highrise buildings
  construction practices....24
  management responsibilities....273
  sanctuaries....307

FIRE SAFETY (cont'd)
industry
  cutbacks....545
information resources
  key references....21
mines
  bibliography....385
offshore oil wells
  firefighting ships...411
planning
  fire-death scenarios....613
polymers
  vehicles....435
public buildings
  regulations (France)....395
pumps
  developmental trends....368
research
  standards and specifications....59
residential occupancies
  interior design....399
risk management
  industry....659
seminars
  1975 Internat....19
standards
  consumer products....648
  international....647
symposia
  combustible materials..6
  NBS program and abstracts....12
transit industry
  smokeless cables....359
US
  status report....60

FIRE SAFETY EDUCATION
industrial fire prevention
  United Kingdom....545
National Fire Academy
  conference....542
programs
  general public....541

FIRE SAFETY TRAINING
industrial
  guidelines....364
National Fire Academy
  conference....542

FIRE SCIENCES
education
  heat transfer fundamentals....110

FIRE SERVICE
academy
  site selection....457

FIRE SERVICE (cont'd)
equipment
  textbook....460
labor relations
  unions....491
management
  deployment policy....571
  urban planning....442
operations analysis
  reorganization....560
personal equipment
  protective clothing..483
physical fitness
  guidebook....446
public relations
  agenda....544
  organization....539
  press officers....543

FIRE SERVICE INSTRUCTORS
International Society of Fire Service Instructors
  fall conference....449

FIRE SERVICE TRAINING SEE: FIREFIGHTER TRAINING

FIRE SETTING SEE: ARSON; INCENDIARISM; PYROMANIA

FIRE SITUATIONS
human behavior
  research possibilities....628

FIRE SPREAD
floor coverings
  corridors....69
prevention
  duct baffles....322
schools
  building performance..42
shipboard
  international standards....407
structural debris
  testing....184
structural protection
  building design....224

FIRE STATIONS SEE: FIREHOUSES

FIRE SUPPRESSION
airborne systems
  aircraft crash fires....328
  forest fires....343
aircraft crash fires
  agents....25
  airborne systems....328
  review....523
  rockets....559

FIRE SUPPRESSION (cont'd)
- aircraft ground fires
  - airfield parameter study...................327
  - dry chemical agents..531
- coal mines
  - conveyor belts.......386
- electric locomotives...408
- fuel fires
  - aircraft engine......330
  - aqueous foam films...532
- halon
  - highrise buildings...305
- hangar decks
  - foam sprinklers......329
- high-expansion foam
  - ship machine compartments.............505
- high-rack warehouses....32
- liquefied gas
  - tests................180
- liquid sodium
  - patent...............321
- medium-expansion foam
  - ship machine compartments.............504
- mines
  - inert gas foam.......373
  - portable extinguishers....................291
  - remote sealing..381, 382
  - sealing system.......387
- peat fires
  - surfactants..........339
- sprinkler heads
  - patent...............316
- sprinkler systems
  - flow regulation......311
  - residential buildings.....................398
- sprinklers
  - textbook.............284
- standpipes
  - textbook.............284
- surfactants
  - chemical fires.......501
  - efficiency...........500
- symposia
  - CTIF..................9
- tanker ships
  - inert gas systems....404
- water curtains
  - automatic............294

FIRE TECHNOLOGY
- advances
  - forum discussion.......5

FIRE TESTS
(a s: testing; testing facilities)
- acoustic boards
  - methods..............125

FIRE TESTS (cont'd)
- aircraft
  - compartments.........185
- bedrooms
  - full-scale...........204
- building officials
  - codes................205
- building structures
  - fire resistance......261
- buses
  - seat cushions........183
- chemicals
  - building materials...127
- class A and B fires
  - dry powder suppression....................529
- compartments
  - description and data......................199
  - fire buildup.....75, 210
  - fire hazard prediction....................201
- concrete structures
  - hollow-core..........190
  - reinforced...........172
- construction materials
  - ASTM Standard E-119..196
- corridors
  - fire spread...........73
- fire buildup
  - corner tests..........68
- fire endurance
  - building codes........65
- fire gases
  - apparatus and methodology...............149
- flammability
  - principles...........619
- floor coverings
  - corridors............195
- full-scale
  - conditions...........202
  - fire behavior........206
  - fire causes..........189
  - fire growth...........76
  - National Bureau of Standards facility.......................203
  - symposium............216
- furniture
  - full-scale...........133
- gypsum boards..........145
- insulation boards
  - methods..............125
- Japan
  - statistics...........207
- mine timbers
  - full scale...........383
- mobile homes
  - evaluation...........181
- paper
  - full-scale...........133
- reinforcing steel
  - thermal behavior.....174

FIRE TESTS (cont'd)
- row houses
  - full-scale...........188
- ship structures
  - time-temperature curve....................268
- small-scale
  - relation to full-scale....................216
- sprinkler control
  - residential..........337
- standardization
  - building regulations......................194
- steel beams
  - hyperstatic and isostatic...............177
- steel columns
  - temperature histories.....................259
- structural assemblies
  - residential buildings.....................145
- structural debris
  - fire behavior........184
- structural elements
  - fire resistance......198
- systems behavior
  - credibility..........217
- tank trucks
  - full scale...........186
- tanks
  - fire behavior........208
- thermoplastic moldings
  - response parameters..123
- wall linings
  - fire buildup..........67
- wall panel furnace
  - heat transfer........187
- wall panels
  - precast concrete.....254
  - silica concrete......252

FIRE THREAT
- nuclear
  - urban areas..........213

FIREFIGHTER SAFETY
- backdraft
  - prediction............62
- hazards identification
  - preventive measures..279

FIREFIGHTER TRAINING
(a s: physical training)
- breathing apparatus
  - instruction book.....478
- correspondence courses
  - London (UK)..........451
- emergency services
  - deployment...........459
- fire simulator
  - projector............458
- instruction methods....448

SUBJECT INDEX

FIREFIGHTER (cont'd)
International Society of Fire Service Instructors
  fall conference......449
National Fire Academy
  goals................450
shipboard firefighting
  Seattle, WA..........447

FIREFIGHTERS
carbon monoxide exposure
  carboxyhemoglobin.....583
duty assignments
  fire prevention......440
fatalities
  analysis.............618
  causes...............614
heart disease
  risk factor analysis.......................622
heat stress
  temperature measurements...................621
injuries
  polyvinylchloride....596
physical condition
  monitoring...........610
physical fitness
  tests................623
protective clothing
  fire resistant fabrics.....................487
retired
  occupational health..492
training...............455

FIREFIGHTING
electrical equipment
  railroads............409
smoke abatement
  US Navy..............324
tactical operations
  nozzle use...........556
wool processing plant..369

FIREFIGHTING EQUIPMENT
component quality
  USSR.................461
developmental trends
  mathematical analysis......................462
directory...............18
textbook
  USSR.................460

FIREFIGHTING FORCES
availability
  deployment policy....571
USSR urban coverage
  risk limits..........657

FIREFIGHTING LOGISTICS
highrise building fires...

FIREFIGHTING (cont'd)
highrise building (cont'd)
 554

FIREFIGHTING OPERATIONS
breathing apparatus
  demand-type..........478

FIREFIGHTING SHIPS
semisubmersible
  offshore oil wells...411

FIREFIGHTING TACTICS
highrise building fires
  analyses.............554
highrise buildings
  water supplies.......533
mathematical calculations
  fire flows...........557
water supplies
  deficient............557

FIREFIGHTING VEHICLES SEE: APPARATUS; AUXILIARY VEHICLES

FIREGROUND COMMAND
tactics display case...558

FIREGROUND CONTROL
multiple units
  leadership aspects...538

FIREHOUSES
relocation
  response parameters..560
replacement
  phased construction program...........569
siting
  evaluation model....565, ...566
  parametric allocation model.............570
  studies..............560
tower ladder allocation
  mathematical model...561

FIREMATICS EXPLORING
youth programs
  fire departments.....540

FIREMEN SEE: FIREFIGHTERS

FIRES-2
data coding
  information report system...........473

FIRRST
fire risk survey
  Berkeley.............400
  households...........400

FLAME ARRESTERS
electrical equipment
  arc containment......280

FLAME DETECTORS
(a s: detectors)
gas ionization
  hydrogen.............230
performance
  test apparatus.......244
testing methods........236

FLAME-FABRIC INTERACTION
preignition processes..111

FLAME RESISTANCE
clothing...............168
  ranking tests........161
  standards............166
cotton/polyester blends
  solubilities.........160
polymers
  research.............164

FLAME RETARDANTS
evaluation mechanism...167
polyurethane foams
  patent...............281

FLAME SPREAD
polymethylmethacrylate
  measurement...........72
  mechanisms............71
porous materials
  radiation fluxes.....108
ship corridors
  fire buildup..........63
solid materials
  fundamental processes......................64

FLAMEOVER
corridor fires
  fire spread...........73

FLAMEPROOF LIGHTING
industrial
  standards............367

FLAMMABILITY
fabrics
  char length...........81
  mixed fibers..........77
furniture
  upholstery............83
multicomponent fibers
  evaluation............84
passenger seats
  transit vehicles.....434

FLAMMABILITY LIMITS
fluorenes..............136
fuel-air mixtures
  explosion hazard

SUBJECT INDEX

FLAMMABILITY (cont'd)
- fuel-air mixtures (cont'd)
  - criteria...........85
- organic compounds
  - estimation methods....78
- premixed and diffusion flames
  - chemical kinetics.....88
  - thermodynamics........88

FLAMMABILITY RESEARCH CENTER
- Univ of Utah
  - dedication............11

FLAMMABILITY TESTS
- aircraft materials
  - development and evaluation...............53
- burn injuries
  - measurement..........619
- clothing
  - proposed standard....645
- critical oxygen index..126
- electrical components..372
- floor coverings
  - shipboard............131
- materials
  - oxygen index.........124
- Nat Bureau of Standards
  - current status.......129
- review.................128

FLAMMABLE FABRICS ACCIDENT CASE AND TESTING SYSTEM SEE: FFACTS

FLAMMABLE FABRICS ACT
- standards
  - sleepwear............648

FLAMMABLE GASES
- fire incidents
  - injuries.............667

FLAMMABLE LIQUIDS
- extinction phenomena
  - thermal theory........95
- fire incidents
  - injuries.............667
- flash points.............31
- industrial occupancies
  - fire safety..........362
- storage
  - safe handling........661
- storage tanks
  - fire protection......334
- wastes
  - industrial............79

FLASH FIRES
- liquids
  - analysis.............31

FLASH POINTS
- aviation fuels
  - comparison...........132
- flammable liquids.......31

FLASHOVER
- calculation
  - computer program......66
- compartments
  - fire resistance.......65
  - fire tests............75
  - modeling.............215
  - secondary features....74

FLICKER PHENOMENON
- infrared detector
  - electronic circuit...234

FLOOR COVERINGS
- ceramic tiles
  - fire resistance......115
- corridor fires
  - behavior..............69
  - fire spread...........73
- corridors
  - fire tests...........195
- fire retardants
  - self-help............170
- flame spread
  - radiation fluxes.....108
- radiative ignition
  - tests................107
- shipboard
  - flammability tests...131
- testing methods
  - fire performance.....192

FLOW CHARTS
- tank fires
  - parameters............61

FLUORENES
- fire and explosion hazard determination........136

FLY ASH-CEMENT SEAL
- mine fires
  - suppression system...387

FOAM CHAMBERS
- new designs
  - structural features..287

FOAM EFFECTS
- diesel generators
  - shipboard............357

FOAM EXTINGUISHANTS
- aircraft crash fires
  - development...........25
  - review...............523
- application rate
  - economics............338

FOAM (cont'd)
- application rates
  - coal-oil fires.......518
- applications
  - conference papers....497
- characteristics
  - air-water interactions....................527
- fire protection
  - aircraft hangars.....333
  - USSR.................509
- fire suppression
  - prospects............498
- fuel fires
  - testing..............532
- high-expansion
  - pipe discharge.......516
  - ship fire suppression.....................505
- mechanical
  - developments.........521
  - mine fires...........373
  - physical properties..506
- medium-expansion
  - firefighting effectiveness...............503
  - ship fire suppressions....................504
- mine fires
  - Rostov, USSR.........376
- physics and chemistry
  - conference papers....507
- production and application
  - conference papers....508
- storage life
  - determination methods.....................499

FOAM FILLING
- mines
  - time calculations....374

FOAM GENERATION
- conference papers......497
- grids
  - cutoff parameter.....288
- methods................497

FOAM GENERATORS
- aircraft fire suppression
  - feasibility study....326
- combustion product temperature
  - foam properties......519
- compressed air
  - calculation method...285
- mechanical
  - patent...............313
- mines
  - conveyor belts.......375
- pipe discharge
  - output reduction.....516
- proportioning techniques
  - evaluation...........286

SUBJECT INDEX

FOAM PROPERTIES
expansion ratio
  determination methods.....................515
temperature effects
  output reduction....504, ...519

FOAM PROPORTIONERS
automatic extinguishers
  proportioning techniques 286

FOAMED MATERIALS
(a s: polyurethane foams)
anechoic chambers
  electric ignition......35
  fire safety...........122
fire resistant
  aircraft seat cushions.. 283
reticulated
  explosion suppression... 524

FOG NOZZLES
dust suppression
  remote control.......295

FOREST FIRES
airborne suppression
  modular systems......343
atlases
  United States........342
Austria
  risk calculation.....650
danger rating
  fuel models..........340
fire losses
  appraisal............655
meteorology
  acoustic sounding....104
risk evaluation
  Austria..............650
simulation
  California...........345

FOREST FUELS
weather effects
  fuel moisture........341

FUEL FIRES
(a s: aircraft fuel fires)
motor vehicles
  spilled fuel ignition... 89

FUEL MODELS
forest fires
  danger rating........340

FUEL SPILLS
(a s: spills)

FUEL SPILLS (cont'd)
motor vehicle fires
  countermeasures.......89
  ignition sources......89
vehicle accidents
  ignition sources.....266

FUEL STORAGE TANKS
(a s: tank fires; fuel
  tanks)
fire prevention
  automatic gauging....361
fire protection
  hydrant valve........535
foam chambers
  structural features..287
foam extinguishers
  patent...............309

FUEL SYSTEMS
aircraft
  fire protection......425

FUEL TANKS
(a s: fuel storage tanks;
  tank fires)
aircraft
  explosion suppression... 524
  fire causes..........417
  fire safety..........420
  flame propagation hazard 419
  ignition proofing....418
  nitrogen inerting....182

FUELS
(a s: aviation fuels)
firesafe
  combat vehicles......431

FURNACES
wall panel
  fire resistance......187

FURNISHED ROOMS
fire hazards
  plastics.............146

FURNISHINGS
transit vehicles
  flammability.........434

FURNITURE
fire tests
  full-scale...........133
  hazards..............146
flammability............83
upholstery material
  flammability..........83

G

GARMENTS SEE: CLOTHING

GAS BOTTLES SEE: GAS
  CYLINDERS

GAS CYLINDERS
rust scouring
  tumblers.............465

GAS DETECTION
mines..................240
semiconducting polymers... 237

GAS IONIZATION
hydrogen
  flame detectors......230

GAS MONITORING
tube bundles
  mine fires...........242

GASES
flow behavior
  testing...............98
mines
  detection systems....240

GERMANY
standards
  smoke control........301

GOLD MINES
fire protection
  detection and alarm
    systems...........379

GYPSUM BOARDS
fire endurance
  testing..............145

H

HALONS
(a s: extinguishants)
dispensing system
  characteristics......332
extinguishants
  structual fires......305
fire extinguishers
  patent...............314
fire protection
  aircraft.............428
methyl bromide
  aircraft fuel fires..330
propane autoignition
  effects..............118
toxicity
  review...............602

SUBJECT INDEX

HALONS (cont'd)
trifluorobromomethane
aircraft fuel fires..330

HANDBOOKS
fire protection
14th edition..........17

HANGAR DECKS
fire suppression
foam sprinklers......329

HAZARD REDUCTION
building design........276
safety systems
dust explosions......274
dust fires...........274

HAZARDOUS CARGOES
inland waterway transport
symposium............642
sea transport
symposium............642

HAZARDOUS MATERIALS
fire codes
American Insurance
Association........631
liquefied gases
ship transportation..639
spill information
retrieval system.....640
transportation
hazards identification.. 638

HAZARDS IDENTIFICATION
chemical industry
loss prevention......635
cotton industry
classification.......636
materials transport
loss prevention......638
preventive measures
firefighter safety...279

HEART DISEASE
firefighters
risk factor analysis.... 622

HEAT LOADS
concrete structures
computer calculation.... 253

HEAT REMOVAL
system design
tests................290

HEAT STRESS
firefighters
measurement methods..621

HEAT STRESS (cont'd)
standards
proposals............644

HEAT TRANSFER
fundamentals
short course.........110
ship fires
compartments.........405
tank fires
model................109

HELICOPTERS
firefighting applications
highrise building fires. 555
rescue services
organization.........548

HIGHRISE BUILDING FIRES
construction practices
deficiencies..........24
evacuation problems....547
helicopter applications
tests................555
incidents
Atlanta, Ga...........43
New Orleans...........46
New York City.........44
suppression
tactics and logistics... 554

HIGHRISE BUILDINGS
codes
restrictive aspects..397
construction practices
fire safety...........24
elevators
fire protection......225
evacuation columns
patent...............553
fire protection
design principles....219
France...............349
fire safety
sanctuaries..........307
occupant safety
management responsibilities..............273
smoke control
pressurization.......308
stairwell pressurization 221, 222
ventilation.....289, 303
steel columns
water-cooling........223
unfinished
fire hazards..........33
water supplies
firefighting tactics.... 533

HOISTING APPARATUS
portable
patent...............467

HOME FIRE PROJECT
fire tests
description and data.... 199
full-scale burns
bedrooms.............204

HOODS
aluminized
evaluation...........488
visor materials......485
smoke protective
visual psychomotor performance..........486

HOSES
drag reduction
slippery water.......528
testing..............526

HOSPITALS
(a s: operating rooms)
electrical hazards
operating rooms......249
fire hazards
anesthetics...........30
operating rooms......249
hazards
fires................249
operating rooms
fire incidents........27
smoke movement
full-scale experiments.. 99

HOTELS
fire hazards
protection measures..346

HUMAN BEHAVIOR
arson
law enforcement......582
reviews..............579
clothing fires
burn injuries........617
fire environments
evacuation studies...550
thermal stresses.....625
fire incidents
dance halls..........348
nightclubs...........348
fire situations
research possibilities.. 628
hotel fires
life safety..........346
incendiarism
reviews..............579
panic simulation
threater fires.......627

SUBJECT INDEX

HYDRANTS
four-way valve
  patent...............535

HYDROCARBON PROCESSING PLANTS
arson
  investigation routine.....................581

HYDROCHLORIC ACID
fire gases
  corrosive effects....148
PVC pyrolysis
  corrosive effects....148

HYDROGEN
gas ionization
  flame detectors......230

HYDROGEN CHLORIDE
aircraft interior materials
  testing..............600
toxicity...............596

HYDROGEN CYANIDE
aircraft interior materials
  testing..............600
polyurethane combustion.......................585
smoke inhalation.......588

HYDROGEN FUELS
vehicles
  tank leakage.........143

HYDROGEN SULFIDE
smoke inhalation.......588

HYPERCUBE QUEUING MODEL
emergency services
  response districts..575, ...576, 577
executive summary......575
program description....577
user's manual..........576

HYPOXIA
smoke inhalation.......588

I

IGNITION HAZARDS
catalytic heaters.......90

IGNITION PROBABILITIES
fabrics
  burn injuries.........93

IGNITION PROCESSES
flame-fabric interaction..

IGNITION (cont'd)
flame-fabric (cont'd)
 111

IGNITION PROOFING
aircraft fuel tanks
  fire causes..........417
  oxygen-deficient air.......................418

IGNITION SOURCES
fuel spills
  countermeasures......266

IGNITION TIMES
fabrics
  prediction............87

IGNITIONS
methane-air
  infrared detectors...241

IMAGERS
infrared
  smoke penetration....103

INCENDIARISM
(a s: arson)
schools
  UK....................42
threat evaluation
  review...............579

INDUSTRIAL BRIGADES
organization and training......................371

INDUSTRIAL OCCUPANCIES
arson
  investigation routine.....................581
fire safety
  flammable liquids....362
  training guidelines..364
flameproof lighting
  standards............367
wool processing
  fire protection......369

INDUSTRIAL RELATIONS
labor unions
  fire service.........491

INDUSTRIAL WASTES
liquid
  flammability..........79

INDUSTRY
fire prevention
  textbook.............360
fire safety
  cutbacks.............545

INERT GASES
cavity fillers
  tanker ships.........404
extinguishants
  mine fires...........388
nitrogen
  aircraft.............182

INFORMATION RESOURCES
fire literature
  data bases............20
fire safety
  key references........21

INFORMATION SYSTEMS
data coding
  FIRES-2..............473
fire data base
  Lawrence Livermore Lab.....................474
fire departments
  management......475, 477
fire service
  computer assisted....537
operational control
  decision making......472

INFRARED DETECTORS
(a s: detectors)
high temperature
  electronic circuits..234
methane-air ignitions..241
testing methods........236

INFRARED IMAGERS
smoke penetration
  mine rescue..........103

INJURIES
electrical
  hospitals............249
flammable liquids
  demographic distribution..................667

INSPECTIONS
construction sites
  fire prevention......278
fire test laboratories
  UK....................56

INSTRUMENTS
infrared imagers
  smoke penetration....103
ionization chambers
  development..........245
oxygen monitors
  reviews..............227
thermesthesiometer
  burn hazard measurements..................616

SUBJECT INDEX

INSULATION BOARDS
- ignition
  - fire test methods....125

INSURANCE
- aircraft accidents
  - US 1963-1974 settlement data................37
- fire risks
  - forests..............650
- plastics plants
  - fire incidents.......660

INSURANCE COMPANIES
- fire prevention
  - role.................649

INTERIOR DESIGNERS
- fire safety education
  - National Fire Academy conference........542

INTERIOR FINISHES
- flammability
  - corner tests..........68

INTERNATIONAL SOCIETY OF FIRE SERVICE INSTRUCTORS
- fall conference
  - firefighter training.......................449

INVESTIGATION SEE: ARSON INVESTIGATION; FIRE INVESTIGATION

IONIZATION CHAMBERS
- development
  - Fire Res Station (UK).......................245

IONIZATION DETECTORS
- (a s: detectors)

IRRITANTS
- smoldering fires
  - combustion products..586

J

JET FUELS SEE: AVIATION FUELS

K

KEROSINE
- aviation fuels
  - fire safety..........415

KITCHEN FIRES
- mobile homes
  - tests................181

L

LABOR UNIONS
- fire service
  - industrial relations.......................491

LABORATORIES
- Fire Science Lab
  - Tokyo, Japan..........55
- fire testing
  - building materials...171
  - certification.........56

LADDER COMPANIES
- tower ladder assignments
  - heuristic model......561

LANDSAT
- data collection platform
  - fire management......344

LARGE LOSS FIRES
- UK
  - 1974.................664

LASERS
- microsurgery
  - larynx and trachea....28

LAUNCH PAD FIRES
- beryllium-water reaction.....................155

LAWRENCE LIVERMORE LAB
- fire data base
  - user's manual........474

LEGISLATION
- fire regulations
  - health and safety act (UK)...............52

LEISURE BUILDINGS SEE: RECREATION BUILDINGS

LIBRARIES
- fire protection
  - risk management......394

LIFE SAFETY
- building codes
  - American Insurance Association.......629
- highrise buildings
  - management responsibilities..............273

LIQUEFIED GAS FIRES
- radiation measurements
  - tests................180
- suppression techniques
  - tests................180

LIQUEFIED GASES
- safe handling
  - ship transportation..639

LIQUIDS
- atomization
  - patent...............319
- flash fires
  - analysis..............31

LIVE LOADS
- calculation
  - mathematical model...258
- office buildings
  - surveys..............258
- survey
  - data analysis.........58

LIVING QUARTERS
- ocean vessels
  - fire loads...........407

LOSS ECONOMICS
- (a s: fire losses)
- fire technology advances
  - forum discussion.......5
- residential
  - evaluation...........656

LOSS PREVENTION
- chemical industry
  - hazards identification.......................635

LOSS REDUCTION
- national enterprises
  - USSR.................658
- warehouse fires
  - USSR 1974-1975........29

LOSSES SEE: FIRE LOSSES

M

MACHINE COMPARTMENTS
- ship fires
  - foam suppression....504, ...505

MANUFACTURERS
- fire equipment
  - directory.............18

MASK COMMUNICATION
- speech amplifiers
  - breathing apparatus..484

SUBJECT INDEX

MATCHBOOKS
child-resistant
  fire prevention......275

MATERIALS
aircraft interiors
  toxic fumes..........421
electrical insulation
  flammability.........372
electrical overheating
  smoke and fumes......119
flammability tests
  critical oxygen index... 126
  review...............128
porous
  flame spread.........108
solid
  flame spread..........64
testing
  smoke density chamber... 156

MATERIALS HANDLING
transportation
  hazards identification.. 638

MATERIALS TESTING
oxygen index
  review...............124

MATTRESS FIRES
prisons
  Florida...............22
  Pennsylvania..........23

MATTRESSES
(a s: bedding)
rubber foam
  explosion hazards....144

MEDICAL FACILITIES
burn care
  New Jersey...........611
  Pennsylvania.........612

MEETINGS
Aircraft Fire Safety
  1975.....48, 49, 50, 64, ...86, 119, 412, 413, ..414, 415, 416, 417, ..418, 419, 420, 421, ..422, 423, 424, 425, ..426, 427, 428, 522, ...523, 524, 525, 559
Aircraft Safety
  1975.................150
Combustion Inst, Western States Section
  fall 1975............118
Fabric Flammability Information Council
  1973.......129, 142, 617

MEETINGS (cont'd)
Flammability and Burning Characteristics of Materials and Fuels
  1975.............151, 87

METAL POWDERS
combustion and explosion
  preventive measures..267

METALS
beryllium
  fire behavior........155
sodium
  fire suppression.....321
  nuclear power plant fires.............393
uranium
  fire experience.......36

METEOROLOGY
acoustic sounding
  forest fire control..104
forest fuels
  moisture content.....341

METHANE FUELS
vehicles
  tank leakage.........143

METHYL BROMIDE
(a s: halons)
extinguishants
  aircraft fuel fires..330

MINE FIRES
automatic protection
  haulage vehicles.....336
coal mines
  physical description.... 390
detection systems......240
extinguishants
  inert gases..........388
fire suppression
  inert gas foams......373
  sealing system.......387
foam suppression
  Rostov, USSR.........376
gas monitoring
  tube bundles.........242
gas sensing............228
incident analysis
  bibliography.........385
prevention
  oxy-cement sealant...380
suppression
  remote sealing..381, 382
ventilation
  air velocity effect..383
  powder extinguishant movement..........517

MINE TIMBERS
fire hazards
  full scale testing...383

MINES
air ducts
  sealing gaskets......377
downwalls
  fire-hazard zones....378
fire suppression
  portable extinguishers.. 291
foam filling
  time calculations....374
metal
  fire protection......379
water curtains
  flow rates...........292

MINING EQUIPMENT
coal augers
  fire protection......384
conveyor belts
  fire suppression.....386
  foam protection......375
haulage vehicles
  fire detection.......336

MOBILE HOMES
fire incidents
  Michigan..............45
fire tests
  evaluation...........181
smoke detectors
  placement............238
standards
  drafting reforms.....643

MODELING
convective flows
  compartment fires.....70
fire buildup
  compartments..........75
fire company allocation
  parametric.....564, 570, ...572
  response parameters..562
fire fatality scenarios
  ranking system.......613
fire protection
  building structures..265
fire protection training
  engineers............453
firehouse siting.......563
  summary..............565
  user's manual........566
flashover
  compartments.........215
heat removal
  system design........290
heat transfer
  tank fires...........109
pool fires
  mathematical.........211

SUBJECT INDEX

MODELING (cont'd)
ship fires
suppression..........200
smoke removal
system design........290
structural fires
Poisson theory.......209
tank fires.............208
torch fires
mathematical.........211
travel time
prediction...........567
water supplies
mathematical.........534

MOLDINGS
thermoplastic
fire tests...........123

MONO-AMMONIUM PHOSPHATE
dry powder
fire suppression.....529

N

NATIONAL BUREAU OF STANDARDS
Center for Fire Research
programs 1976.........59
fire tests
full-scale facility..203

NATIONAL FIRE ACADEMY
educational goals
summary..............450
fire safety education
conference...........542

NATIONAL FIRE DATA CENTER
mission..................4

NATIONAL FIRE PREVENTION AND CONTROL ADMINISTRATION
academy
site selection.......457
fire prevention conference
1976 announcement.....10
organization.............4

NATIONAL FIRE PROTECTION ASSOCIATION
handbooks
fire protection.......17

NEWS MEDIA
fire information
public relations.....543,
..................544

NIGHTCLUBS
fire incidents
human behavior.......348

NIGHTCLUBS (cont'd)
fire protection
controls.............347

NITROGEN
extinguishants
fabric and cellulosic
fires.............510

NITROGEN INERTING
aircraft
fuel tanks...........182

NOMEX
aluminized
protective clothing..487
floor coverings
shipboard............131

NOZZLES
constant gallonage
tactical use.........556
variable gallonage
tactical use.........556

NUCLEAR EXPLOSIONS
fire threat
urban areas..........213
thermal radiation
fire buildup.........106

NUCLEAR FIRES
extinguishants
carbon microspheres..511

NUCLEAR REACTOR SAFETY
power plants
fire prevention......392
sodium fires
progress report......393

O

OCCUPATIONAL HEALTH
retired firefighters
counseling...........492

OCCUPATIONAL SAFETY
firefighters
mortality study......618

OFFICE BUILDINGS
fire loads
surveys..............258

OFFSHORE OIL WELLS
fire safety
firefighting ships...411
rescue operations
slides...............552

OIL
spill information
retrieval system.....640

OIL WELLS
offshore
firefighting ships...411

OLD AGE HOMES
(a s: nursing homes)
smoke movement
tests..................96

OPERATING ROOMS
(a s: hospitals)
fire hazards
anesthetics...........30
laser surgery.........28
hazards
electrical fires and
injuries..........249

OPERATIONAL CONTROL
information systems
decision making......472

OPTICAL RADIATION
fire detectors
polymeric pyroelectric
sensors...........233

ORDINANCES
smoke detectors
residential occupancies.
...................51

ORGANIC COMPOUNDS
flammability limits
estimation methods....78

OXYGEN GENERATION
potassium superoxide
breathing apparatus..479

OXYGEN INDEX
flammability tests
materials............126
materials testing
review...............124
premixed and diffusion
flames
flammability limits...88

OXYGEN MONITORS
reviews................227

P

PAINT FACTORIES
fire suppression.......297

SUBJECT INDEX

PAINT FIRES
fixed extinguishers
  foam and CO(2).......297

PAINTS
combustion products
  toxicity.............593

PANELS SEE: CEILING PANELS; WALL PANELS

PANIC SEE: HUMAN BEHAVIOR

PAPER
fire tests
  full-scale...........133

PARACHUTES
thermal survivability
  aircraft crash fires.......................169

PARAMEDICS
emergency medical care
  textbook.............605

PASSENGER SEATS
(a s: seat cushions)
polyimide foams
  fire resistant.......283
transit vehicles
  flammability.........434

PATENT APPLICATION
smoke detectors
  ultraviolet..........232

PATENTS
AUTOMATIC SPRINKLER VALVE (US)................317
DEVICE FOR LIQUID ATOMIZATION (USSR).........319
DEVICE FOR THE PREVENTION OF FIRE SPREAD (Japan).....................322
DISCHARGE HEAD FOR A FIXED FIRE EXTINGUISHING SYSTEM (US).........323
EXTINGUISHER CHARGING SYSTEM (US).........312
FIRE EXTINGUISHER CABINET (US)................315
FIRE EXTINGUISHERS (US)........................314
FIRE EXTINGUISHING SYSTEMS (USSR)..............318
FIRE PUMP CONTROL APPARATUS (US)............320
FLAME-RETARDANT POLYURETHANE FOAMS (US)....281
FLUID CONTROL DEVICE AND A FIRE PROTECTION SYSTEM INCORPORATING SAID DEVICE (US).........310

PATENTS (cont'd)
FLUID DISCHARGE ASSEMBLY HAVING A TILTABLE DISCHARGE PORTION AND A DISCHARGE CONTROL SYSTEM INCORPORATING A PLURALITY OF SAID ASSEMBLIES (US).....316
FOAM FIRE-EXTINGUISHING DEVICE FOR WALLED CONTAINERS (US).....309
FOAM GENERATOR (USSR)..313
FOUR-WAY HYDRANT VALVE (US)................535
HIGH-RISE EVACUATION AND RESCUE DEVICE (French). 553
IMPROVEMENTS IN FLAME ARRESTERS (UK)......280
IMPROVEMENTS RELATING TO FIRE EXTINGUISHING SPRINKLER SYSTEMS (UK). 311
METHOD OF PREVENTING HIGH TEMPERATURE LIQUID SODIUM FIRES (Japan)........................321
MODULATED HYDROGEN ION FLAME DETECTOR (US)........................230
PORTABLE HOISTING AND EVACUATION APPARATUS (US)................467
PROTECTIVE BREATHING MASK (GDR)...............482
RESCUE SLIDE (Raddningsrutschbana) (Swedish).......................552

PEAT FIRES
suppression
  surfactants..........339

PERSONAL EQUIPMENT
(a s: protective clothing)
breathing apparatus
  lightweight.....489, 490
hoods
  firefighting.........488
turnout coats
  performance..........481

PETROCHEMICAL INDUSTRY
fire extinguishants
  steam................520

PHOSPHATES
fire retardants
  wood.................163

PHOTOELECTRIC DETECTORS SEE: SMOKE DETECTORS

PHYSICAL FITNESS
firefighters
  tests................623

PHYSICAL TRAINING
fire service
  guidebook............446

PLASTICS
(a s: polymers; thermoplastics)
combustion products
  corrosive effects....251
  toxicity.............152
fire hazards
  furniture and furnishings..............146

PLASTICS PLANTS
fire analysis
  insurance............660

PLATFORMS
elevating
  economic effectiveness.....................463

POLAR REGIONS
apparatus
  low ground pressure..470

POLICE/FIRE CONSOLIDATION
fire protection
  negative aspects.......3
  positive aspects.......2

POLY(IMIDAZOLE)FEROCENE
semiconducting polymer
  gas detector.........237

POLY(IMIDAZOLE)THIOPHENE
semiconducting polymer
  gas detector.........237

POLYAMIDE-CELLULOSE MIXTURES
thermal behavior
  analysis.............112

POLYAMIDES
fabrics
  decomposition products.....................154

POLYESTER PHTHALOCYANINE
semiconducting polymer
  gas detector.........237

POLYETHYLENE OXIDE
drag reduction
  measurement..........528

SUBJECT INDEX

POLYIMIDE FOAMS
seat cushions
  aircraft..............283

POLYMERIC ANTIMIST
aviation fuels
  fire resistance.......414

POLYMERIC PYROELECTRIC SENSORS
fire detectors
  optical radiation.....233

POLYMERS
(a s: plastics; rubber; thermoplastics)
aircraft interiors
  fire dynamics........422
burning intensity
  test methods..........117
combustion products
  hydrogen cyanide.....585
  toxicity........589, 592
fire hazards
  vehicles.............435
fire safety
  vehicles.............435
flame resistance
  research.............164
latex and emulsion
  fire hazards.........135
pyrolysis and combustion
  industrial evaluation.....................590
semiconducting
  gas detection........237
smoke
  toxicology...........597
smoke measurement
  density..............157
thermoplastic
  fire buildup..........94

POLYMETHYLMETHACRYLATE
flame spread
  measurement...........72
  mechanisms............71

POLYPROPYLENE
dynamic properties
  mechanical and thermal.....................113

POLYURETHANE FOAMS
carbon impregnated
  fire performance tests.....................122
combustion products
  toxicity.............598
fire retarded
  combustion products..595
flame retardants
  patent...............281

POLYURETHANE (cont'd)
mattresses
  fires.............22, 23
pyrolysis products
  toxicity testing.....599
smoke
  properties...........151

POLYURETHANES
combustion products
  hydrogen cyanide.....585
full-scale fire tests
  photoelectric smoke detectors.........235
smoke
  properties...........159

POLYVINYL FLUORIDE
pyroelectric sensors
  fire detection.......233

POLYVINYLCHLORIDE
combustion products
  corrosion damage.....251
electrical insulation
  fire retardation.....355
flame retardant
  electrical insulation.....................358
pyrolysis products
  corrosive effects....148
smoke
  properties......151, 159
toxicity...............596

POLYVINYLIDENE FLUORIDE
pyroelectric sensors
  fire detection.......233

POOL FIRES
aircraft fuels
  dry chemical extinguishants..............531
modeling
  mathematical.........211

POPULATION DENSITIES
New York City
  income correlation...651

POTASSIUM SUPEROXIDE
oxygen generation
  breathing apparatus..479

POWDER EXTINGUISHANTS SEE: DRY POWDER; EXTINGUISHANTS

POWER PLANTS
cable ducts
  fire protection......352
combustible materials
  flammability tests...372

POWER PLANTS (cont'd)
design
  fire protection......391
nuclear
  reactor safety.......392
  sodium fires.........393

PRECRASH FIRES
aircraft cabins
  analysis..............49
aircraft washrooms
  intoxication fatalities.....................50

PRESS OFFICERS
fire service
  public relations.....543

PRESSURIZATION SYSTEMS
smoke control
  design requirements..298
stairwells
  smoke control.........97

PRESSURIZED LIQUIDS
tank rupture
  cloud expansion......141

PRINTING INK FACTORIES
fixed fire protection
  requirements.........366

PRISONS
fire incidents
  Florida...............22
  Pennsylvania..........23

PROCESSING EQUIPMENT
chemical plants
  fire hazards.........370

PROPANE
autoignition
  promotion by halons..118

PROPERTY LOSSES
(a s: fire losses)
residential
  evaluation...........656

PROTECTIVE CLOTHING
(a s: clothing)
fire resistant
  firefighters.........487
fire service
  bibliography.........483
  personal equipment...483
firefighters...........481
hoods
  materials evaluation.....................485
  problem identification.....................488
  visual psychomotor per-

SUBJECT INDEX

PROTECTIVE (cont'd)
hoods (cont'd)
      formance..........486
thermal burns
  evaluation...........130

PUBLIC BUILDINGS
fire safety
  regulations (France)....
 395
steel structures
  fire protection......396

PUBLIC EDUCATION
(a s: education)
fire safety
  programs.............541

PUBLIC RELATIONS
fire service
  agenda...............544
  organization.........539
press officers
  fire service.........543

PUMPER-LADDERS
(a s: apparatus)
crew composition
  USSR.................439

PUMPS
liquid
  fire safety..........368
performance
  calculation..........466

PYROLYSIS
cellulosics
  dynamics.............121

PYROLYSIS HAZARDS
polymers
  industrial evaluation...
 590

R

RADIATION EFFECTS
pool fires
  wood ignition........105

RADIATIVE HEATING
floor coverings
  corridor fires........73

RADIATIVE IGNITION
fabrics
  prediction............87
floor coverings
  tests................107

RADIO EQUIPMENT
fire communications center
  Houston, TX..........494

RAIL TRANSPORTATION
electrical equipment
  fire safety..........409
hazard reduction
  safety program.......438
tank cars
  heat tests...........436

RAILROAD FIRES
fire sources
  prevention and suppression..............408

RAND NEW YORK INSTITUTE
Fire Project
  program..............443

RANN
fire research
  bibliography..........13

RAPID TRANSIT
safety program.........438

RECREATION BUILDINGS
fire incidents
  UK 1965-1974..........26

REFUGE AREAS
firesafe
  concrete buildings...625

REGULATIONS SEE: BUILDING CODES

RELOCATION
fire protection resources
  computer programs....568

REPORTING SYSTEMS
fire incidents
  national.............666

RESCUE EQUIPMENT
building fires
  limits of application...
 549
portable
  building exteriors...467

RESCUE OPERATIONS
aircraft ground fires
  airfield parameter study
 327
building fires
  apparatus and equipment.
 549
evacuation
  flow densities.......546
  rates................546

RESCUE OPERATIONS (cont'd)
highrise buildings
  tactics..............533
offshore oil wells
  slides...............552
reporting methods
  fire departments.....476

RESCUE SERVICES
breathing apparatus
  suitability tests....608
helicopter
  organization.........548
highrise building fires
  helicopters..........555

RESIDENTIAL FIRES
backdraft
  prediction............62
losses
  urban poor...........651
nuclear explosions
  fire buildup.........106
smoke explosions
  structural causes.....62

RESIDENTIAL OCCUPANCIES
(a s: highrise buildings; hotels; mobile homes; motels)
fire safety
  interior design......399
fire suppression
  spinkler systems.....398
multi-family
  fire suppression.....398
row houses
  full-scale fire tests...
 188
safety survey
  Berkeley.............400
smoke detectors
  ordinances............51
steel structures
  fire protection......396

RESPIRATORS
(a s: breathing apparatus)
aerosol protection
  patent...............482

RESPIRATORY SYSTEM
emergency medical care
  principles...........606

RESPIRATORY TRACT
fire hazards
  evaluation...........626
injuries
  smoke inhalation.....584

RESPONSE PARAMETERS
fire companies
  parametric model.....564

RESPONSE (cont'd)
fire companies (cont'd)
  travel time model....567
fire departments
  modeling.............563
  travel time....560, 574,
  ....575, 576, 577
firehouse siting
  evaluation model......566
travel time
  fire companies.......562

RETIREMENT HOMES SEE:
  NURSING HOMES; OLD AGE
  HOMES

REVIEWS
flame spread
  solid materials........64
oxygen index...........124
respiratory complications
  smoke inhalation.....584

RISK EVALUATION
firefighting operations
  response time........560

RISK LIMITS
firefighting forces
  USSR urban coverage..657

RISK MANAGEMENT
fire protection
  libraries............394
fire safety
  industry.............659
fire technology advances
  forum discussion.......5
national enterprises
  USSR.................658

ROAD TRANSPORTATION
tank trucks
  fire resistance testing.
 186
vehicles
  fireproof............437

ROCKET MOTOR DISPENSER
dry chemical extinguishants
  aircraft ground fires...
 531

ROCKETS
fire suppression
  aircraft crash fires....
 559

ROOFS
fire retardants
  self-help............170

RUBBER
foam
  flammability.........144

RUGS SEE: FLOOR COVERINGS

RUST SCOURING
air cylinders
  tumblers.............465

S

SAFETY ENGINEERING
chemical plants
  principles...........365

SAFETY PROFESSIONALS
fire protection
  organization...........1

SANCTUARIES SEE: REFUGE
  AREAS

SATELLITE OBSERVATIONS
LANDSAT
  fire management......344

SCALING TESTS
beams
  fire behavior........212

SCHOOLS
fire incidents
  building performance..42
  fire development......42

SCUBA DIVERS
recovery teams
  training requirements....
 452
rescue teams
  training requirements...
 452

SEALING GASKETS
air ducts
  fire hazards.........377
  mines................377

SEAT CUSHIONS
(a s: passenger seats)
aircraft interiors
  fire-resistant foams....
 283
buses
  ignition tests.......183

SEMINARS
Fire Safety
  1975 Internat.........19

SHEATHS
sandwich configuration
  fire protection......272

SHIP ACCIDENTS
(a s: accidents)
collisions
  New York Harbor.......40

SHIP FIRES
collisions
  report................40
compartments
  heat transfer........405
corridor finishings
  flame spread..........63
diesel generators
  foam suppression.....357
extinguishants
  fire gas recirculation
    method.............530
machine compartments
  foam suppression....504,
 505
research recommendations
  USSR.................405
suppression
  modeling.............200

SHIP MACHINE COMPARTMENTS
fire extinguishment
  fire gas recirculation
    method.............530

SHIP TRANSPORTATION
liquefied gases
  safe handling........639

SHIPBOARD FIREFIGHTING
training program
  Seattle, WA..........447

SHIPS
collisions
  fire incidents........40
compartments
  hazards classification..
 637
corridors
  flame spread..........63
decks
  fire endurance.......406
fire protection
  study................430
  USSR.................403
holds
  foam sprinklers......329
living quarters
  fire loads...........407

SHOPPING CENTERS
fire protection
  Germany..............351

SUBJECT INDEX

SHOPPING MALLS SEE: SHOPPING CENTERS

SIMULATION
building fires
  projector system.....458
fire severity
  compartments.........256
panic
  theater fires........627

SLIDES
offshore oil wells
  patent (Swedish).....552

SLIPPERY WATER
drag reduction
  measurement.....526, 528

SMOKE
aircraft interiors
  measurement..........424
chemical properties
  determination........147
detection system
  spacecraft...........246
imaging
  infrared.............103
physical properties
  determination........147
polymers
  properties...........159
  toxicity.............592
  toxicology...........597
polyurethane
  properties...........151
polyvinylchloride
  properties...........151
wood
  properties...........151

SMOKE ABATEMENT
fire fighting
  US Navy..............324

SMOKE CONTROL
buildings
  escape routes.........97
corridor seals
  inflatable...........302
pressurization
  elevator shafts......303
  highrise buildings...308
  stairwells......221, 222
pressurization systems
  design requirements..298
standards
  Germany..............301
structural fires
  system design........102
ventilation
  corridors............303
  highrise buildings...289

SMOKE CURTAINS
inflatable
  automatic............302

SMOKE DENSITY
polymers
  measurement.....156, 157

SMOKE DENSITY CHAMBER
sample orientation
  effect...............197

SMOKE DETECTORS
(a s: detectors)
escape routes
  old age homes.........96
mobile homes
  placement............238
photoelectric
  fire tests...........235
  mobile home study....238
residential
  ordinances............51
  sensitivity and siting....................243
  Taguchi..............331
ultraviolet
  patent application...232

SMOKE DIVERS
breathing apparatus
  training program.....454

SMOKE EXPLOSION
(a s: backdraft)

SMOKE EXPLOSIONS
structural causes
  prediction............62

SMOKE GENERATION
aircraft fires
  cabin interiors......153
aircraft materials
  nonmetallic..........119
furniture
  testing..............146
natural materials
  measurement..........157
polymers
  measurement..........135
ship fires
  modeling.............200

SMOKE HOODS
aircraft fires
  visual psychomotor performance..........486

SMOKE INHALATION
fire injuries
  respiratory complications...............584

SMOKE INHALATION (cont'd)
physiological effects
  preventive measures..588

SMOKE MEASUREMENTS
smoke density chamber
  sample orientation...197

SMOKE MOVEMENT
escape routes
  control measures......97
flow behavior
  testing...............98
hospitals
  full-scale experiments......................99
old age homes
  tests.................96
structural fires
  prediction...........102

SMOKE OBSCURATION
evacuation methods
  voice guidance.......551

SMOKE POISONING
clinical diagnosis.....591

SMOKE PROTECTION
plastic hoods
  visual psychomotor performance..........486

SMOKE REMOVAL
electrostatic filters
  development......55, 304
stairwells
  conventional..........97
system design
  tests................290
ventilation
  highrise buildings...289

SMOKING
fire causes
  UK 1965-1974..........26

SMOLDERING FIRES
combustion products
  irritants............586
mine fires
  gas sensing..........228
  semiconductor devices.....................228

SODIUM CARBOXYMETHYLCELLULOSE
viscous water
  loss reduction.......513
  test results.........512

SODIUM FIRES
reactor safety
  progress report......393

SODIUM FIRES (cont'd)
suppression
  patent..............321

SODIUM SILICATES
fire retardants
  wood................163

SOLID MATERIALS
spontaneous combustion
  literature search....134

SOUNDING SEE: ACOUSTIC
    SOUNDING

SPACECRAFT
smoke detection
  research............246

SPECIFICATIONS
fire hoses
  survey..............468
fire safety
  research............59

SPEECH AMPLIFIERS
communication system
  breathing apparatus..484

SPILLS
(a s: fuel spills)
hazardous materials
  information retrieval
      system............640
liquefied gas
  fire tests..........180

SPONTANEOUS COMBUSTION
solids
  literature search....134

SPRAYS
dry powder
  area coverage........296

SPRINKLER HEADS
discharge assembly
  patent..............316
valve assemblies
  fluid control........310
  patent..............310
water distribution
  vertical plane.......325

SPRINKLER SYSTEMS
fire suppression
  textbook............284
flow regulation
  patent..............311
residential occupancies
  feasibility study....398

SPRINKLER VALVES
automatic control
  patent..............317

SPRINKLERS
aircraft fires
  ships...............329
detection
  performance..........247
discharge head
  patent..............323
residential fire protection
  testing.............337
warehouse fire protection
  evaluation..........335

SQUIBB BUILDING
fire
  evacuation problems..547

STAIRWELL PRESSURIZATION
smoke control
  system design........222
  test results.........221

STANDARDS
apparatus
  performance..........471
ASTM E-119
  fire tests...........196
clothing
  flame resistance.....166
commercial
  voluntary............646
consumer products
  drafting reforms.....643
fire resistance
  US and UK............264
fire risks
  buildings and structures
     250
fire safety
  research.............59
  symposia.............12
fire tests
  compartments.........201
flameproof lighting
  industrial...........367
flammability tests
  clothing.............645
heat stress
  proposals............644
international..........191
  fire safety..........647
  shipboard fire spread...
     407
mandatory
  consumer products....648
smoke control
  Germany..............301
voluntary
  status and prospects....
     646

STANDPIPES
fire suppression
  textbook............284

STATISTICS
aircraft accidents
  US 1963-1974..........37
aircraft crash fires
  UK...................25
electrical fires
  USSR................662
fire damage
  UK..................652
fire departments
  Germany 1975.........663
fire fatalities
  causes..............615
  firefighters.........618
fire losses
  UK 1974..............664
fire tests
  Japan...............207
firefighter fatalities
  causes..............614
large loss fires
  US..................654
vehicle fires
  West Germany..........34
warehouse fires
  USSR 1974-1975........29

STEAM
extinguishant
  petrochemical industry..
     520
  petroleum industry...520

STEEL
thermal behavior
  test results.........174

STEEL BEAMS
composite
  fire resistance......177
computer programs
  fire resistance......176
fire resistance
  tests...............178
fire stability
  theory..............176
isostatic
  fire tests...........179
simply supported
  fire behavior........212

STEEL COLUMNS
fire exposure
  temperature histories...
     259
water-cooled
  highrise buildings...223

STEEL RIDERS
fire resistance
  tests..................178

STEEL STRUCTURES
fire behavior..........271
fire protection.........396
water filled
  input requirements...220

STONE DUST
flame quenching
  coal dust fires.......82

STORAGE CABINETS
fire extinguishers
  patent................315

STORAGE LIFE
foam compounds
  determination methods.....................499

STRUCTURAL DEBRIS
fire spread
  characteristics......184

STRUCTURAL ELEMENTS
concrete column
  temperature field....262
fire exposure
  failure modes........212
fire resistance
  standards............264
  test summaries.......198
reinforced concrete
  temperature fields...175
steel and concrete
  fire behavior........271

STRUCTURAL FIRES
dynamics
  nuclear explosions...213
rescue operations
  apparatus and equipment....................549
smoke movement
  prediction...........102

SUBWAY CARS
interiors
  fire hazard evaluation.....................432
toxic gases
  combustion products..601

SUPPRESSION SEE: FIRE SUPPRESSION

SURFACTANTS
(a s: wetting agents)
fire suppression
  efficiency tests.....500
  new agents...........502

SURFACTANTS (cont'd)
fire suppression (cont'd)
  peat fires...........339
  USSR.................502
solutions
  chemical fires.......501

SYMPOSIA
Combustion
  European 1975........159
  Internat 1974....71, 72, ...73, 95, 108, 345, ...389, 390
CTIF
  Jul/Aug 1975...........9
Fire Safety of Combustible Materials
  1975..........6, 93, 215
Fire Standards and Safety
  1976..4, 12, 60, 74, 75, ...94, 102, 201, 217, ..604, 619, 620, 626, ..634, 646, 647, 648, ...666
Full-Scale Fire Tests
  1974.....43, 44, 45, 46, ...47, 76, 188, 189, ..202, 203, 204, 205, ...206, 216
Hazardous Cargo Transport
  1975.................642
Toxicity and Physiology of Combustion Products
  1976..................11

SYSTEMS ANALYSIS
fire departments
  operations...........445
fire incidents
  research significance.......................47

T

TACTICS
display case
  fireground command...558

TAGUCHI GAS SENSORS
mine gases
  performance..........228
residential
  testing..............331
smoke detection
  fire tests...........235

TANK CARS
heat effects
  mathematical model...436

TANK FIRES
(a s: fuel tanks; fuel storage tanks)

TANK FIRES (cont'd)
buildup
  parameters............61
heat transfer
  model................109
modeling...............208
rupture
  cloud expansion......141

TANK TRUCKS
road transportation
  fire tests...........186

TANKER SHIPS
collisions
  fires.................40
oceangoing
  inert gas fillers....404

TEMPERATURE FIELDS
structural elements
  fire exposure........262

TEMPERATURE MEASUREMENTS
burn hazard
  thermesthesiometer...616
wet and dry bulb
  firefighter heat stress...................621

TESTING
(a s: fire tests; flammability tests)
aerospace materials
  fire resistance......423
aircraft interior materials
  combustion gas toxicity..............424, 600
building materials
  fire protection......191
building structures
  fire protection......191
clothing
  flammability ranking.......................161
fabrics
  scale correlation....160
foam extinguishants
  fuel fires...........532
ship compartment fires
  fire gas recirculation
    extinguishment method..................530
smoke detectors
  photoelectric........235
smoke movement
  old age homes.........96
surfactants
  fire suppression efficiency..........500
toxic gases
  aircraft materials...153

SUBJECT INDEX

TESTING FACILITIES
fire protective clothing
  aviation..............130
flammability
  polymers.............164
full-scale
  National Bureau of
    Standards..........203
laboratories
  certification..........56
room burns
  BF Goodrich Co........164

TESTING METHODS
combustion toxicology..599
fabric flammability
  ranking...............161
fire protective clothing
  aviation..............130
flame detectors.........236
floor coverings
  fire behavior.........192

TEXTILES SEE: FABRICS

THEATER FIRES
human behavior
  panic simulation......627

THERMAL INSULATION
aluminum structures
  fire protection.......193

THERMAL RADIATION
nuclear explosions
  fire buildup..........106

THERMAL STRESSES
physiological response
  fire environments....625

THERMESTHESIOMETER
burn hazard measurements.. 616

THERMOPLASTICS
(a s: plastics)
moldings
  fire tests...........123
polypropylene
  mechanical properties... 113
smoke measurements
  smoke density chamber... 197

TIME-TEMPERATURE CURVES
compartment fires.......65

TOLUENE DIISOCYANATE FIRES
suppression
  extinguishants.......514

TORCH FIRES
modeling
  mathematical.........211

TOWER LADDERS
firehouse allocation
  mathematical model...561

TOXIC GASES
aircraft interiors
  measurement.....153, 424
combustion products....587
hydrogen cyanide
  polyurethane combustion. 585

TOXICITY
aircraft interior materials
  laboratory methods...600
assessment
  animal experiments...604
combustion products
  plastics.............152
extinguishants.........603
  review................602
hydrogen chloride
  firefighters.........596
inhalation
  combustion products..594
paints
  combustion products..593
polymers
  combustion products..589

TOXICOLOGICAL HAZARDS
combustion products
  subway cars..........601

TRAFFIC ACCIDENTS
buses
  fire investigation....38
vehicle fires
  West Germany..........34

TRAINING
(a s: education; firefighter training)
arson investigation
  program..............580
deployment
  emergency fire services. 456
emergency medical care
  textbook........605, 606
emergency medical services
  ambulance personnel..609
engineers
  mathematical model...453
fire-protection specialists
  mathematical model...453
fire service...........455

TRAINING (cont'd)
SCUBA divers
  recovery teams.......452

TRANSIT INDUSTRY
fire protection
  codes.................401
fire safety
  smokeless cables.....359

TRANSIT VEHICLES
(a s: subway cars)
interiors
  fire hazard evaluation.. 432
passenger seats
  fire hazards.........435
  flammability.........434
traffic accidents
  bus fires.............38

TRANSPORTATION
(a s: road transportation; ship transportation)
hazardous materials
  safe handling........641
rail
  safety program.......438

TRAVEL PARAMETERS
emergency vehicles
  empirical data.......574

TRAVEL TIME
fire company allocation
  decision model.......562
fire response
  prediction model.....567

TRIFLUOROBROMOMETHANE
extinguishants
  aircraft fuel fires..330

TUBE BUNDLES
gas monitoring
  mine fires...........242

TUMBLERS
rust scouring
  air cylinders........465

TURNOUT COATS
performance............481

TURRETS
remote control system
  evaluation...........469

TYNDALL EFFECT
sensing mechanism
  smoke detectors......238

SUBJECT INDEX

U

ULTRAVIOLET DETECTORS
(a s: detectors)
high temperature
  electronic circuits..234
smoke
  patent application...232
testing methods........236

UNDERLAYMENTS SEE: FLOOR
  COVERINGS

UNITED KINGDOM
aircraft crash fires
  statistics............25
fire losses
  1974.................652
large loss fires
  statistics 1974......664
recreation building fires
  survey................26

UPHOLSTERY
furniture
  flammability..........83
interlining
  flame retardant......146

URANIUM FIRES
case histories
  analyses..............36

URBAN AREAS
fire threat
  nuclear explosions...213

URBAN PLANNERS
fire safety education
  National Fire Academy
    conference........542

URBAN PLANNING
fire departments
  performance analysis....
 443
fire service
  management...........442

URBAN POOR
residential fires
  losses...............651

USSR
fire protection
  foams and wetting agents
 509
fire safety standards
  building construction...
 218

UTILITY CHASES
gypsum boards
  fire endurance testing..
 145

V

VALVE ASSEMBLIES
hydrants
  four-way.............535
sprinkler heads
  fluid control........310

VANDALISM
law enforcement........582

VARNISH FACTORIES
fire suppression.......297
fixed fire protection
  requirements.........366

VARNISH FIRES
fixed extinguishers
  foam and CO(2).......297

VEHICLE ACCIDENTS
fuel spills
  fire prevention......266

VEHICLE FIRES
accident caused
  analysis..............34
analyses...............665
buses
  investigation.........38
nonaccident
  analysis..............34
spilled fuel
  ignition sources......89

VEHICLES
(a s: apparatus)
combat
  firesafe fuels.......431
fire hazards
  polymers.............435
fire safety
  earthquakes..........410
  polymers.............435
fireproof
  design...............437
fuel leakage
  fire hazards.........143
low ground pressure
  polar regions........470

VENTILATION SYSTEMS
fire protection
  firestop baffles.....322
smoke control
  designs..............102
  highrise buildings...289

VENTING
gas explosions.........100

VIOLENCE
law enforcement........582

VISCOUS WATER
sodium carboxymethylcellulose..............513
  test results.........512

VISORS
firefighters hoods
  gold-coated plastic..485
gold-coated
  evaluation...........488

VOICE GUIDANCE
evacuation methods
  smoke obscuration....551

W

WALL COVERINGS
ceramic tiles
  fire resistance......115

WALL PANELS
corner tests
  fire buildup..........68
fire buildup
  corner tests..........67
fire resistance........263
precast concrete
  fire tests...........254
silica concrete
  fire tests...........252

WALLBOARDS SEE: CHIPBOARDS; FIBERBOARDS;
  GYPSUM BOARDS

WAREHOUSE FIRES
high racks
  buildup and suppression.
 32
loss reduction
  USSR 1974-1975........29

WAREHOUSES
fire protection
  sprinkler evaluation....
 335

WATER COOLING
steel columns
  highrise buildings...223

WATER CURTAINS
automatic
  development..........294
flow rates
  mines................292

SUBJECT INDEX

WATER CURTAINS (cont'd)
radiation shielding
  liquefied gas spill
    fires..............180

WATER DAMAGE
prevention
  nozzleman efficiency....
   556
sprinkler systems
  automatic shutoff....231

WATER DISTRIBUTION
sprinkler heads
  vertical plane.......325

WATER SPRAYS
fire protection
  flammable liquids
    storage tanks.....334

WATER SUPPLIES
(a s: fire flows)
deficient
  firefighting tactics....
   557
firefighting
  statistical analysis....
   534
highrise buildings
  firefighting tactics....
   533

WEARING APPAREL SEE:
  CLOTHING

WETTING AGENTS
(a s: surfactants)
applications
  conference papers....497
fire protection
  USSR.................509
fire suppression
  prospects............498
generation methods
  conference papers....497
physics and chemistry
  conference papers....507
production and application
  conference papers....508

WIND TUNNELS
fire research
  design...............214

WINDOW COVERINGS
fire incidents
  survey................39

WOOD
fire retardants
  phosphates...........163
  sodium silicate films...
   163

WOOD (cont'd)
ignition time
  radiant heating......105
smoke
  properties...........151

WOOL
processing plant
  fire protection......369

WORLD TRADE CENTER
fire
  construction deficienci-
    es..................24
  evacuation problems..547

Y

YOUTH PROGRAMS
firematics exploring
  fire departments.....540

SOURCE INDEX

BOOKS

AUTOMATIC SPRINKLER AND STANDPIPE SYSTEMS...284
CODE OF PRACTICE, MEANS OF ESCAPE IN CASE OF FIRE. 630
ELEMENTS OF FIRE AND ARSON INVESTIGATION.......578
EXTRICATION AND CASUALTY HANDLING TECHNIQUES.... 607
FIGHTING HIGH-RISE BUILDING FIRES...........554
FIRE-FIGHTING EQUIPMENT... 460
FIRE PREVENTION CODE...631
FIRE PREVENTION IN INDUSTRY AND AGRICULTURE.... 360
FIRE PROTECTION HANDBOOK.. 17
FIRE PROTECTION REFERENCE DIRECTORY............18
FIRE RESISTANCE OF BUILDING STRUCTURES......261
FIRE RESISTANCE OF CONCRETE STRUCTURES.... 171
HIGH-RISE, AN ENDANGERED SPECIES.............397
MANAGING THE LIBRARY FIRE RISK................394
NATIONAL BUILDING CODE.... 629
PHYSICAL FITNESS AND THE FIRE SERVICE........446
PREVENTION OF SUDDEN IGNITION OF POWDERS AND EXPLOSIONS OF DISPERSED GAS SYSTEMS.........267
PRINCIPLES OF EMERGENCY RESPIRATORY CARE....606
PRINCIPLES OF FIRE SAFETY STANDARDS FOR BUILDING CONSTRUCTION........218
PROTECTIVE BREATHING APPARATUS...........478
TEXTBOOK OF BASIC EMERGENCY MEDICINE.........605

CONFERENCES

Arson and Incendiarism Conf
  1975, Jul 29-30, Washington, DC..........579
  AD-A018 726/0GA......579
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    Paper
      61...............112

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    Pages
      5-12.............219
      25-29............273
      30-35..............8
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  1974, All-Union Fire Protection Res Inst, Moscow
    Pages
      64-75............498
      155-160..........499
      161-167..........506
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    Pages
      10-18............500
      25-29............501
      30-34............502
      51-58............509
      59-63............503
      100-108..........339
      109-116..........504
      117-125..........505
      141-144..........373
Foams. Production and Application. Papers of the All-Union Sci and Tech Conf. Part 3...497
  1974, All-Union Fire Protection Res Inst, Moscow
    Pages
      3-8..............285
      9-14.............288
      15-22............287
      23-32............286
      67-69............374
      70-72............375
      86-96............376
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    Paper
      75-HT-12.........111

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  1975, Jun 23-25, Denver, CO
    Pages
      61-67..............1
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  1975, Lyndon B Johnson Space Center, Houston, TX
    Pages
      833-854...........53
    Paper
      70................53
Wool Textile Research Conf, 5th Internat, Proc
  1975, Sep 6, Aachen, Germany............77

CONGRESSES

Congres du Gas (Gas Congress), 92-nd
  1975, 16-19 Sep, La Baule, France.....180
Precast Concrete Industry Cong, BIBM, 8th Internat, Proc
  1975, May 12-19, Stresa, Italy.............260
Precast Concrete Industry Congress, BIBM, Internat, 8th, Proc
  1975, May 12-19, Stresa, Italy..............54

JOURNALS

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  7(2):91-102, 1975....141
Adv Fire Retard Text, Prog Fire Retard Ser
  5:271-370, 1975......124
Allg Forstztg
  86(3):79-80, 1975....650
Amts Mitteilungsbl Bundesanst Materialpruef
  6(1):15-22, 1975.....248
Anesth Analg
  54(1):152-4, 1975.....27
  55(1):146-147, 1976...28
Ann Surg
  181(2):151-6, 1975...591
Antincendio protez civ
  27(6):442-450, 1975..297
Appl Ergon
  6(3):132-8, 1975.....441

SOURCE INDEX

JOURNALS (cont'd)
ASCE Proc. J Struct Div
101(ST7):1531-9, 1975......................271
101(ST9):1947-60, 1975....................209
102(ST1):51-63, 1976.......................173
ASHRAE J
18(2):20-2, 1976.....305
18(2):29-33, 1976....222
18(2):34-40, 1976....221
ASME Trans. Ser C. J Heat Transfer
97(4):598-604, 1975..262
ASME Trans. Ser H. J Eng Mater Technol
97(4):367-70, 1975...306
BBC-Nachr
57(8/9):487-492, 1975......................391
Bezop tr prom-sti
(8):49-50, 1975......356
(8):56-57, 1975......295
Brandforsvar
12(8/9):5, 1975......251
Brandschutz
30(1):6-8, 1976......608
30(1):12-16, 1976....546
30(2):38-41, 1976....351
30(3):71-74, 1976....225
30(5):110-114, 1976..544
30(6):162-165, 1976..663
Cah Cent Sci Tech Batim
161(1325):1-13, 1975.......................250
Chem-Ing-Tech
47(16):683, 1975.....208
48(4):281-287, 1976..365
Chem Tech
28(2):98-102, 1976...370
Combust Sci Technol
9(5/6):255-9, 1975...510
Cour Norm
(246):517-520, 1975..276
Dtsche Farben Z
29(9):376-378, 1975..163
Electr Commun
50(3):210-211, 1975..358
Electron Ind (GB)
1(2):39,41, 1975.....140
Electron Power
21(21/22):1187, 1975.......................367
Elektr Stn
(11):74-75, 1975.....352
Elektrotech Z
B27(17):460, 1975....355
B28(1):2-9, 1976.....123
Eng Min J
176(9): 119, 1975....380
177(2):80-5, 1976....379
Environ Health Perspect
11:163-89, 1975......592

JOURNALS (cont'd)
Environ Health (cont'd)
11:163-189, 1975.....597
11:197-202, 1975.....590
Exchange
3(2):51-6, 1975......492
Fire
68(842):135-6, 1975...55
68(847):393, 396-397, 1976...............96
68(847):416-418, 1976..6
68(848):453-456, 1976......................451
68(849):516-517, 1976.......................56
68(849):523-524, 1976......................491
68(851):607-609, 1976......................633
68(851):612-613, 1976..5
68(852):17-18, 1976..649
69(852):43,45, 1976....7
Fire Chief
20(2):33-35, 1976...473
20(3):35-37, 1976...540
20(3):39-41, 1976...494
20(3):42-44, 1976...447
20(4):59-61, 1976......3
20(4):62-64, 1976......2
20(4):66-69, 1976...452
20(5):29-32, 1976...543
20(5):35-38, 1976...557
20(5):39-40, 1976...627
20(6):42-43, 1976.....62
20(6):44-45, 1976...580
Fire Command
42(6):34-5, 1975.....496
42(8):56-60, 1975...558
43(1):18-20, 1976...609
43(3):24-26, 1976...636
43(4):20-23, 1976...588
43(4):26-28, 1976...614
43(5):28-31, 1976...476
Fire Eng
128(5):32,34-5, 1975.......................371
128(11):23-5, 1975...481
128(11):29-31, 1975..455
129(1):20-21, 1976...493
129(1):22-23, 1976...533
129(1):26-32, 1976...449
129(1):100-101, 1976.......................555
129(3):32-36, 1976...610
129(3):40-41, 1976...448
129(3):54,56,60-61, 1976...................353
129(4):14-16, 1976...556
129(4):27-28, 1976...450
129(4):33-36, 1976...542
129(4):43-44, 1976...279
129(4):63-66, 1976...541
129(5):20-23, 1976...464
129(5):24-25, 1976...454

JOURNALS (cont'd)
Fire Eng (cont'd)
129(5):31, 1976.......51
129(6):24-25, 1976...548
129(6):27, 1976......465
129(6):72, 1976.......10
Fire Eng J
36(101):5-8, 1976....638
36(101):10-12, 1976..274
36(101):15-16, 1976..539
36(101):18-21, 1976..520
36(101):22-26, 1976..635
36(102):5-6, 1976....659
36(102):16-20, 1976..621
36(102):20-21, 1976..361
36(102):31-34, 1976..440
Fire Internat
5(51):18-28, 1976....289
5(51):37-46, 1976....347
5(51):48-52, 1976....348
5(51):59-64, 1976.....24
5(51):73-83, 1976....172
5(51):85-91, 1976....349
5(51):93-99, 1976....466
Fire J
69(3):11-3, 1975.....615
70(1):5-10,17, 1976...22
70(1):13-17, 1976....401
70(1):48,53-57, 1976.......................398
70(1):59-61, 1976....651
70(1):65-70, 1976....547
70(1):74-75, 1976....632
70(3):11-17, 1976....275
70(3):20-22, 117-118, 1976..............613
70(3):37-39, 1976....643
70(3):45-48, 1976....125
70(3):70-76, 1976.....23
Fire Prev
(112):19-23, 1976....664
(112):24-30, 1976.....25
(112):35-41, 1976.....26
(113):13-16, 1976....350
(113):21-28, 1976....364
(113):33-34,36-37, 1976.....................52
(113):38-39, 1976....652
(114):15-20, 1976....363
(114):23-30, 1976....362
Fire Prev Sci Technol
(11):21-5, 1975......194
Fire Prot Rev
39(422):18,20-21,23, 1976..............299
39(423):61,63,65,67, 1976..............298
39(423):69,71-72, 1976........................224
39(423):77,79, 1976..115
39(423):83,85,87, 1976........................116
39(426):210-211,213,214, 1976..............226

JOURNALS (cont'd)
Fire Prot Rev (cont'd)
39(427):267,269-270, 1976..............191
Fire Technol
11(2):95-8, 1975.....511
11(2):99-110, 1975...562
11(2):119-31, 1975...105
11(4):241-54, 1975...307
11(4):255-60, 1975...514
11(4):261-9, 1975....308
11(4):274-81, 1975...117
11(4):282-93, 1975...128
For Sci
21(2):135-9, 1975....341
Gorno spasat delo
(10):3-7, 1975.......519
(10):12-16, 1975.....292
(10):16-20, 1975.....296
(10):20-22, 1975.....518
(10):22-26, 1975.....291
(10):30-32, 1975.....517
(10):33-37, 1975.....377
(10):42-44, 1975.....378
Hydrocarbon Process
54(6):Sec 1: 149-50, 1975..............654
54(8):65-6, 1975......21
55(2):7-8, 70-71, 74, 75, 79, 1976......581
IEEE Proc
63(10):1371, 1975.....35
IEEE Trans Biomed Eng
BME21(5):425-7, Sep 1974 616
COM 75-10608/9GA.....616
Ind Eng Chem Prod Res Dev
14(3):204-210, 1975..122
Ind Vernice
29(10):2-25, 1975....366
Inf Process Manage
12(1):53-61, 1976.....20
Instrum Technol
22(10):55, 1975......229
ISA Trans
14(2):129-36, 1975....85
J Am Med Assoc
235(4):390-392, 1976.... 583
235(4):393-7, 1976...596
J Br Fire Serv Assoc and Ind Fire Prot Assoc
3(4):154-155, 1975...545
J Chem Educ
52(2):A107,111-112, 1976 31
J Combust Toxicol
3(1):5-23, 1976......594
3(1):24-31, 1976.....149
3(1):32-60, 1976.....599
3(1):71-83, 1976.....593
J Consumer Prod Flammability
1(4):84-113, 1975...255

JOURNALS (cont'd)
J Consumer Prod (cont'd)
3(1):10-20, 1976.....166
3(1):21-61, 1976......83
3(1):62-8, 1976.......81
J Fire Flammability
6(2):105-18, 1975.....84
6(2):130-9, 1975......78
6(4):492-8, 1975.....272
7(1):71-103, 1976....228
J Fire Retard Chem
2(3):195, 1975.......167
J For
73(6):347-50, 1975...340
73(10):633-9, 1975...104
73(11):715-9, 1975...655
J Mines Met Fuels
23(3):135-7, 1975.....82
J Occup Med
17(11):693-695, 1975.... 622
J Pediatr
87(1):1-7, 1975......584
J Polym Sci, Polym Chem Ed
13(12):2709-2723, 1975.. 585
J Polym Sci: Polym Lett Ed
13(5):293-7, 1975....595
J Prestr Concr Inst
20(5):44-64, 1975....254
21(1):40-49, 1976....190
J Soc Automot Eng Jap
29(7):691-701, 1975..665
Khim prom
(8):28-31, 1975.......79
(12):903, 1975.......136
Koatsu gasu
12(6): 247-253, 1975.... 368
Kunstst Plast
22(9):53-5, 1975.....126
Maschinenschaden
48(4):119-124, 1975..148
Melliand Textilber
57(1):58-64, 1976....138
57(1):72-78, 1976....114
Nat Saf News
111(4):91-3, 1975....227
111(6):78-82, 1975...644
Nav Eng J
87(6):59-66, 1975....193
Offshore Serv
8(6):16, 1975........411
Oper Res
22(2):275-7, 1975....561
Polizei Tech Verkehr
20(9):86-87, 1975.....34
Polym Eng Sci
15(10):697-702, 1975.... 113
Pozhar delo
(4):23, 1975.........512
(10):24-25, 1975......32

JOURNALS (cont'd)
Pozhar okhrana
1:5-49, 1974.........137
1:50-93, 1974........165
1:94-154, 1974.......402
Prakt Anaesth
10:192-203, 1975......30
Prof Saf
20(12):24-7, 1975....661
Prom energ
(9):4-6, 1975........354
Prot Civ Secur Ind
(245)):8-20, 1975....395
Publ Pers Manage
4(5):305-10, 1975....623
Q Rep Railw Tech Res Inst (Japan)
16(2):92-3, 1975.....409
Rep Fire Res Inst Japan
(41):1-7, 1976.......551
(41):33-48, 1976.....479
(41):49-61, 1976.....480
(41):62-75, 1976.....586
Rep Fire Sci Lab (Japan)
(11):12-5, 1974......300
(11):25-28, 1974.....294
(11):29-38, 1974......98
(11):39-49, 1974.....410
(11):54-9, 1974......304
(11):60-3, 1974......302
(11):81-3, 1974......207
Rubber Age
107(11):47, 1975.....164
Sb Tr VNII protivopozhar oborony
(2)..................261
(2):3-24, 1974.......253
(2):25-45, 1974......263
(2):46-57, 1974......252
(2):58-71, 1974......269
(2):72-8, 1974.......270
(2):85-91, 1974......396
(2):92-100, 1974.....174
(2):121-6, 1974......303
(2):149-67, 1974.....220
(2):168-73, 1974.....268
(5)..................403
(5):3-15, 1974.......162
(5):16-27, 1974.......63
(5):28-46, 1974......407
(5):47-64, 1974......406
(5):65-74, 1974......589
(5):75-79, 1974......515
(5):80-83, 1974......516
(5):84-88, 1974......357
(5):90-98, 1974......639
(5):99-106, 1974.....637
(5):107-112, 1974....404
(5):113-121, 1974....405
Schweiz Feuerwehr Z
101(11):464-470, 1975..9
Science
187(4178):742-4, 28 Feb 1975..............598

SOURCE INDEX

JOURNALS (cont'd)
Sharyo to Denki
  26(6):22-5, 1975.....408
Siemens Z
  49(12):773-778, 1975.......................537
Stahl Eisen
  95(7):312, 1975......223
Surg Clin North Am
  55(4):959-966, 1975..249
Tech Mod
  67(10):39-40, 1975...369
Telecommun J
  42(11):660-2, 1975...372
Text Chem Color
  8(2):19-22, 1976.....139
  8(3):38-43, 1976.....161
Text Inst Ind
  14(3):79-82, 1976....135
Text Res J
  45(11):790-796, 1975.......................160
Tr Inzh-ekon Fak Rizh Politekhn In-ta
  (4):141-6, 1974......513
VFDB Z
  24(3):87-99, 1975.....97
  24(3): 100-101, 1975.......................550
  24(3): 101-108, 1975.......................549
  24(3): 108-113, 1975.......................346
  24(3):113-117, 1975...33
  24(3):117-118, 1975..278
  25(1):1-9, 1976......538
  25(1):21-28, 1976....301
  25(1):29-31, 1976....127
  25(1):32-35, 1976....660
  25(2):37-40, 1976....560
  25(2):41-50, 1976.....80
  25(2):50-55, 1976....290
  25(2):55-56, 1976....192
  25(2):57-60, 1976....109
  25(2):60-61, 1976....521
  25(2):62-63, 1976.....61
Vopr ekon pozhar okhrane
  (3):3-14, 1974.......439
  (3):15-30, 1974......277
  (3):31-37, 1974......657
  (3):38-43, 1974......453
  (3):44-50, 1974......463
  (3):51-57, 1974......653
  (3):58-67, 1974......658
  (3):68-72, 1974......662
  (3):73-81, 1974.......29
  (3):82-94, 1974......293
  (3):95-101, 1974.....534
  (3):102-110, 1974....495
  (3):111-117, 1974....462
  (3):118-128, 1974....536
  (3):129-136, 1974....472
  (3):137-154, 1974....461

JOURNALS (cont'd)
Zentralbl Arbeitsmed Arbeitsschutz
  25(5):133-139, 1975..587

MEETINGS
Aircraft Fire Safety, AGARD Propulsion and Energetics Panel Meeting, 45th, Proc, Oct 1975
  1975, Apr 7-11, Rome, Italy.............412
    Paper
      1................413
      2................414
      3................415
      4................416
      5................417
      6................418
      7................419
      8................420
      9................421
      10...............422
      11...............423
      12...............424
      13...............119
      14...............150
      15................64
      16...............524
      17...............425
      18...............426
      19...............427
      20...............559
      21...............522
      22...............523
      23...............428
      24...............525
      25................86
      26................48
      27................49
      28................50
Combustion Inst Meeting, Western States Section, Fall 1975
  1975, Oct 20-21, Stanford Res Inst, Menlo Park, California..118
Fabric Flammability Information Council Meeting, 7th Annual, Proc
  1973, Dec 5, New York, NY................129
    Pages
      205-226..........142
      236-253..........617
  AD-247 026/8GA.......142
  PB-246 730/6GA.......617
Flammability and Burning Characteristics of Materials and Fuels

MEETINGS (cont'd)
  Meeting, Combustion Inst, Joint Central and Western States Sections, Spring
  1975, Apr 21-22, San Antonio, Texas....151
    Paper
      6, Session No. IV.....................87

PATENTS
French
  2,225,926............553
GDR
  110,763..............482
Japan
  49-44518.............322
  74-18327/B...........321
Swedish
  374,662..............552
UK
  1,385,598............280
  1,396,377............311
US
  3,821,986............323
  3,859,565............320
  3,860,092............467
  3,871,457............310
  3,871,614............535
  3,872,928............316
  3,872,999............315
  3,874,455............317
  3,874,458............314
  3,875,980............312
  3,876,010............309
  3,926,868............281
  3,938,956............230
USSR
  446,279..............318
  454,028..............313
  455,746..............319

REPORTS
Acad for Educational Development, Inc, NY
  NFPCA CR-76/01.......457
  PB-248 092/9GA.......457
Aerospace Med Res Labs
  AD-A011 538..........602
  AD-A011 861..........603
  AMRL TR-74-125.......603
  AMRL TR-74-143.......602
Aerotherm Acurex Corp
  Aerotherm 74-116.....169
  CSCL 01/3............169
Air Force Systems Command
  AFAPL TR-74-97.......246

SOURCE INDEX

REPORTS (cont'd)
Air Force Systems (cont'd)
AFAPL TR-75-70........91
ASD TR-75-39.........168
Army Mobility Equipment Res and Dev Center
AD-A014 226..........328
DoD AGFSRS-75-2......328
Atomics Internat Div
AI ERDA-13155........393
Battelle Pacific Northwest Labs
HAN 64841.............36
Building Res Estab (UK)
BRE CP-4-76...........42
BRE CP-11-76.........628
BRE CP-21-76.........146
BRE CP-22-76.........152
BRE CP-24-76..........41
BRE CP-25-75.........338
BRE CP-29-75.........247
BRE CP-31-75.........256
BRE CP-32-75.........239
BRE CP-36-75.........144
BRE CP-37-75.........264
BRE CP-38-75.........245
BRE CP-42-75.........334
BRE CP-45-75.........265
BRE CP-70-75.........528
BRE G-(R6)...........198
Bureau of Mines
BuMines IC-8683......336
BuMines RI-8035......241
BuMines TPR-92.......242
PB-242 624/5.........241
PB-246 704/1GA.......336
California Inst of Technol
......................70
Calspan Corp
FRA ORD-75-33........436
PB-241 365/6ST.......436
Centre Technique Industriel de la Construction Metallique (France)
Doc CECM 3-74/2F.....179
Doc CECM 3-74/6F.....178
Doc CECM 3-74/7F.....259
Doc No 2.10.20-3.....133
Doc No 2.10.20-4.....177
Civil Eng Lab (Navy)
AD-A021 845/3GA......470
CEL TN-1422..........470
Coast Guard
AD-A021 429/6GA.......40
USCG NTSB-MAR-75-6....40
Coast Guard Res and Dev Center
AD-A020 979/1GA......530
CGR DC-32-75.........530
USCG D-187-75........530
Comprehensive Health Planning Agency of Southern New Jersey
HRP 0004532/8GA......611

REPORTS (cont'd)
Comprehensive Health Planning Assoc of Western Pennsylvania
HRP 0003803/4GA......612
David W. Taylor Nav Ship Res and Dev Center
AD-A021 939/4GA......430
Dayton Univ Res Inst
AD-A014 225..........327
DoD AGFSRS-75-1......327
Defense Civil Preparedness Agency
DCPA RE-24............15
Denver Res Inst
BUMINES OFR-43-76....282
PB-250 389/4GA.......282
Dept of the Air Force
AD-D001 991/9........232
PAT-APPL-621 338/GA..232
Dept of the Environ and Fire Offices' Committee (UK)
Fire Res Note 1023....90
Fire Res Note 1026...100
Fire Res Note 1029....67
Fire Res Note 1032...101
Fire Res Note 1034....16
Fire Res Note 1042...529
Deputy Chief of Staff for Res, Dev and Acquisition (US Army).......431
Dow Chemical Usa
AD-A022 706/6GA......330
N00019-75-C-0172.....330
Environ Protection Agency
EPA DF-75/001A.......640
PB-243 662...........640
Epsco Labs
AD-A014 653..........484
Rept 5081-1..........484
Factory Mutual Res Corp
AD-A017 545/5GA......333
AFWL TR-75-119.......333
FMRC 21011.3..........92
FMRC 21011.6.........199
FMRC 22442...........337
FMRC 22445...........333
FMC Corp
AD-A013 179..........343
AFWL TR-73-271.......343
Foersvarets Forskningsanstalt
FOAC-20016-D6-A3.....106
Foster-Miller Assoc, Inc
BuMines OFR-77(1)-75....
.....................381
BuMines OFR-77(2)-75....
.....................382
PB-245 898/2GA.......381
PB-245 899/0GA.......382
Foster-Miller Associates
BuMines OFR-26-76....387
PB-250 611/1GA.......387

REPORTS (cont'd)
Geological Survey
NASA CR-146363.......344
Georgia Inst of Technol
NSF RA/S-74-019......442
PB-240 655/1GA.......442
Gillette Res Inst
BuMines-OFR-45-76....240
PB-251 715/9GA.......240
Harvard Univ...........121
TR-2.................656
Idaho Univ
BuMines OFR-29-76....385
PB-250 540/2GA.......385
UI BMR-13............385
IIT Res Inst
IITRI J6340-FR.......243
NBS GCR-75-51........243
PB-247 483/1GA.......243
Inst TNO for Building Materials and Building Structures (Netherlands)
BI-75-91.............212
BI-76-7..............176
Internat Assoc of Firefighters
NBS GCR-76-60........618
Johns Hopkins Univ
APL FPP TR20..........13
NSF RA/E-75-039.......13
Kidde (Walter) and Co, Inc
BuMines OFR-83-75....383
PB-245 903/0GA.......383
Lease 'AFEX', Inc
BuMines OFR-25-76....384
PB-249 865/7GA.......384
Massachusetts Inst of Technol
NSF RA/E-73-191......624
PB-242 582/5.........624
McDonnell-Douglas Corp
NASA CR-134885.......237
Michigan Technol Univ
BuMines OFR-15-76....388
PB-249 340/1GA.......388
Middlesex Polytechnic, Hendon (UK)
Fire Res Note 1033...526
Nat Acad Sci
PB-244 971/8ST.......435
Nat Aeronautics and Space Admin
CSCL 01C.............185
JSC-09832............433
NASA TM-X-58165......433
NASA TM-X-62471......185
Nat Aviation Facilities Experim Center
AD-A017 061/3GA......332
AD-A018 148/7........600
AD-A021 665/5GA......182
AD-A023 413/8GA......153
FAA NA-74-57.........600

SOURCE INDEX

REPORTS (cont'd)
Nat Aviation (cont'd)
FAA NA-74-59.........332
FAA NA-75-25.........182
FAA NA-75-54.........153
FAA RD-75-37.........600
FAA RD-75-105........332
FAA RD-75-119........182
FAA RD-76-7..........153
Nat Bureau of Standards.........................645
AD-A014 830..........233
AFAPL TR-74-16.......233
COM 75-10419.........120
COM 75-10750.........183
COM 75-11015..........69
COM 75-11018..........14
NBS BSS-72...........145
NBS BSS-85...........258
NBS SP-416-76.........59
NBS TN-666...........143
NBS TN-858...........257
NBS TN-861............57
NBS TN-879............68
NBSIR 75-679.........120
NBSIR 75-691..........69
NBSIR 75-694.........471
NBSIR 75-700.........235
NBSIR 75-710.........210
NBSIR 75-718.........183
NBSIR 75-728.........233
NBSIR 75-736..........14
NBSIR 75-782.........195
NBSIR 75-784.........667
NBSIR 75-788.........181
NBSIR 75-794.........187
NBSIR 75-901.........156
NBSIR 75-902..........39
NBSIR 75-903..........99
NBSIR 75-920.........325
NBSIR 75-956.........244
NBSIR 75-966.........601
NBSIR 75-967.........107
NBSIR 75-971.........432
NBSIR 76-982..........58
NBSIR 76-990.........331
NBSIR 76-1016........238
NBSIR 76-1028........231
NBSIR 76-1030........197
NBSIR 76-1076.........88
PB-246 859/3GA........99
PB-246 860/1GA.......156
PB-246 862/7GA.......667
PB-247 203/3GA.......187
PB-247 537/4GA.......145
PB-247 654/7GA.......244
PB-248 643/9GA.......195
PB-248 699/1GA........58
PB-248 913/6GA.......325
PB-249 539/8GA........39
PB-249 540/6GA........59
PB-249 776/6GA.......432
PB-250 768/9GA.......601
PB-250 843/0GA.......181

REPORTS (cont'd)
Nat Bureau of (cont'd)
PB-251 413/1GA.......107
PB-251 415/6GA.......231
PB-251 769/6GA.......331
Nat Tech Information Service
NTIS PS-76/0268/3GA..483
PS 75/286/5ST........641
Nat Transp Safety Board
NTSB HAR-75-8.........38
PB-248 776/7GA........38
Nav Air Dev Center
AD-A021 234/0GA......130
NADC 75286-40........130
Nav Res Lab
AD-A020 048/5GA......132
NRL MR-3191..........132
Nav Surface Weapons Center
AD-A014 228..........532
AD-A019 919/0GA......134
DoD AGFSRS-75-4......532
NSWC WOL TR-75-153...329
NSWC WOL TR-75-159...134
Navy Clothing and Textile Res Unit
AD-A011 420..........488
AD-A013 333..........131
AD-A015 310..........485
AD-A020 963/5G.......487
CSCL 06/7............488
TR-111...............488
TR-113-Rept 2........485
TR-114, 3-74.........487
New York City Rand Inst
AD-A022 169/7GA......443
AD-A022 214/1GA......444
AD-A022 271/1GA......445
P-5416...............444
P-5426...............443
P-5456...............445
PB-250 439/7GA.......577
PB-250 440/5GA.......575
PB-250 441/3GA.......576
PB-250 443/9GA.......570
PB-250 444/7GA.......572
PB-250 460/3GA.......574
PB-250 463/7GA.......459
PB-250 464/5GA.......573
PB-250 465/2GA.......569
R-1506-NYC...........568
R-1566-3-HUD.........563
R-1566-4-HUD.........573
R-1566-5-HUD.........569
R-1615-NYC-HUD.......564
R-1618-1-HUD.........565
R-1618-2-HUD.........566
R-1624-NYC...........567
R-1646-1-HUD.........570
R-1646-2-HUD.........572
R-1687-HUD...........574
R-1688-1-HUD.........575
R-1688-2-HUD.........576
R-1688-3-HUD.........577

REPORTS (cont'd)
New York City (cont'd)
R-1784-1-HUD.........456
R-1784-2-HUD.........459
North Central Forest Experim Station
FSGTR NC-16..........342
PB-248 755/1GA.......342
Nuclear Regulatory Commission
NUREG-0050...........392
PB-249 674/3GA.......392
Rand Corp
AD-A022 151/5GA......571
P-5420...............571
Royal Armament Res and Dev Estab, Fort Halstead (UK)
AD-A017 447/4GA......186
RARDE 7/75...........186
Santa Clara Univ, CA
AD-A021 509/5GA......625
ME 76-1..............625
Scott Aviation Corp
CSCL 06K........489, 490
ER-1075-Vol-1........489
ER-1075-Vol-2, Rev A.......................490
NASA CR-144561.......489
NASA CR-144562.......490
Solar
NASA CR-147496.......283
SO-6-4446-0..........283
Stanford Res Inst
AD-A018 342/6GA......213
AD-A018 798/9GA......184
NASA CR-137690........37
NBS GCR-75-50........196
PB-247 939/2GA.......196
SRI Proj PYU-8150....170
Systems Sci and Software
FRA ORD-75-53........211
PB-250 731/7GA.......211
SSS R-74-2436........211
Transit Dev Co, Inc
PB-241 851/5ST.......434
PB-242 953...........438
TDC/500-74/3.........434
UMTA DC-06-0091-75-1.......................438
Transit Development Co, Inc
PB-241 850/7ST.......359
TDC/500-74/2.........359
Ultrasystems, Inc
DOT HS-801-722........89
DOT HS-801-744.......266
Dyn Sci-2310-75-118...89
Dyn Sci-2310-75-119..266
PB-245 888/3..........89
PB-246 281/0GA.......266
Univ of California (Berkeley)
PB-242 346/AS.........66

REPORTS (cont'd)
- Univ of (cont'd)
  - PB-242 441/AS........175
  - UCB FRG 75-1..........65
  - UCB FRG 75-2..........66
  - UCB FRG 75-6.........399
  - UCB FRG 75-8.........175
  - UCB FRG 75-17........262
  - UCB FRG 75-18........437
  - UCB FRG 75-19........110
  - UCB FRG WP 75-5......400
  - UCID 16916...........474
- Univ of New Mexico
  - AD-A017 610/7GA......335
  - AFWL TR-75-102.......335
- Univ of Notre Dame
  - PB-242 236/AS........214
  - TR-37191-74-5........214
- Univ of Utah
  - FRC UU-42............154
  - FRC UU-44............157
  - FRC UU-49............158
  - UTEC 75-025..........154
  - UTEC 75-055..........157
- Univ of Washington
  - AD-A011 373..........200
  - CSCL 13/12...........200
- Urban Observatory of San Diego
  - NSF RA-760037........468
  - NSF RA-760038........458
  - PB-252 299/3GA.......468
  - PB-252 306/6GA.......458
- US Dept of Interior
  - BuMines TPR-87.......103
- US Dept of Justice.....582
- US Nav Acad
  - USNA EPRO-15.........324
- USAC Project
  - FDC PDC-001..........477
  - PB-249 177/7GA.......475
  - PB-249 178/5GA.......477
  - USAC LBC2a...........477
  - USAC LBC2b,0620-FS-01.......................475
- Verband der Sachversicherer, e.v. (FRG)
  - NBSIR 76-1040........236
- Walter Kidde and Co, Inc
  - BuMines OFR-27-76....386
  - PB-250 368/8GA.......386
- Westinghouse Electric Corp
  - WANL TNR-070.........155
- Wright-Patterson AFB
  - AD-A014 227..........531
  - AD-A015 733..........486
  - AD-A016 763..........429
  - AD-A021 485/8GA......326
  - AD-A022 482/4GA......469
  - AD-A023 843/6GA......234
  - AFAPL TR-74-71-Pt-1..429
  - AFAPL TR-75-111......234
  - AMRL TR-75-55........486
  - DoD AGFSRS-75-3......531

REPORTS (cont'd)
- Wright-Patterson (cont'd)
  - DoD AGFSRS-75-6......326
  - DoD AGFSRS-76-1......469

SEMINARS

- FIRE SAFETY. ABSTRACT SURVEY OF THE REPORTS OF THE IVth INTERNATIONAL FIRE PROTECTION SEMINAR..............19

SYMPOSIA

- Combustion Symp, 2nd European
  - 1975, Sep, Orleans, France
    - Paper
      - 114..............159
- Combustion Symp, 15th Internat, Proc
  - 1974, Aug 25-31, Toshi Center Hall, Tokyo, Japan
    - Pages
      - 103-114..........389
      - 115-126..........390
      - 147-155..........345
      - 183-192...........72
      - 217-231...........71
      - 255-265..........108
      - 305-313...........95
      - 763-774...........73
- Fire Safety of Combustible Materials Symp, 1st Internat
  - 1975, Oct 15-17, Edinburgh, Scotland...215
    - Paper
      - 10................93
- Fire Standards and Safety Symp, Final Program and Abstracts
  - 1976, Apr 5-6, Nat Bureau of Standards, Gaithersburg, MD...12
    - Paper
      - 1.................60
      - 2................666
      - 3................620
      - 4................619
      - 5.................94
      - 6.................74
      - 7.................75
      - 8................102
      - 9................217
      - 10...............634
      - 11...............646

SYMPOSIA (cont'd)
- Fire Standards (cont'd)
  - 1976, Apr 5-6, (cont'd)
    - Paper (cont'd)
      - 12...............648
      - 13...............647
      - 14...............626
      - 15...............604
      - 16...............201
      - 17.................4
- Full-Scale Fire Tests Symp, Proc, 1975
  - 1974, Nov 11-12, Lancaster, PA...........216
    - Pages
      - 1-4...............44
      - 4-8...............43
      - 9-14..............46
      - 14-19.............45
      - 19-24............189
      - 24-38............202
      - 39-45.............47
      - 45-48............203
      - 49-60............204
      - 60-69............188
      - 70-76............206
      - 77-87.............76
      - 89-95............205
- Toxicity and Physiolcgy of Combustion Products Symp, Internat, Program
  - 1976, Mar 22-26, Skaggs Auditorium, Univ of Utah, Salt Lake City, UT.................11
- Transport of Hazardous Cargoes by Sea and Inland Waterway Symp, Internat, Fourth, Proc
  - 1975, 26-30 Oct, Jacksonville, FL......642
  - AD-A023 505/1GA......642
  - USCG D-24-76.........642

REPORT NUMBER INDEX

AD-247 026/8GA.........142
AD-A011 373............200
AD-A011 420............488
AD-A011 538............602
AD-A011 861............603
AD-A013 179............343
AD-A013 333............131
AD-A014 225............327
AD-A014 226............328
AD-A014 227............531
AD-A014 228............532
AD-A014 653............484
AD-A014 830............233
AD-A015 310............485
AD-A015 733............486
AD-A016 763............429
AD-A017 061/3GA........332
AD-A017 447/4GA........186
AD-A017 545/5GA........333
AD-A017 610/7GA........335
AD-A018 148/7..........600
AD-A018 342/6GA........213
AD-A018 726/0GA........579
AD-A018 798/9GA........184
AD-A019 919/0GA........134
AD-A020 048/5GA........132
AD-A020 963/5G.........487
AD-A020 979/1GA........530
AD-A021 234/0GA........130
AD-A021 429/6GA.........40
AD-A021 485/8GA........326
AD-A021 509/5GA........625
AD-A021 665/5GA........182
AD-A021 845/3GA........470
AD-A021 939/4GA........430
AD-A022 151/5GA........571
AD-A022 169/7GA........443
AD-A022 214/1GA........444
AD-A022 271/1GA........445
AD-A022 482/4GA........469
AD-A022 706/6GA........330
AD-A023 4 [illegible]/8GA........153
AD-A023 505/1GA........642
AD-A023 843/6GA........234
AD-D001 991/9..........232
AEROTHERM 74-116.......169
AFAPL TR-74-16.........233
AFAPL TR-74-71-PT-1....429
AFAPL TR-74-97.........246
AFAPL TR-75-70..........91
AFAPL TR-75-111........234
AFWL TR-73-271.........343
AFWL TR-75-102.........335
AFWL TR-75-119.........333
AGF 23.................527
AI ERDA-13155..........393
AMRL TR-74-125.........603
AMRL TR-74-143.........602
AMRL TR-75-55..........486
APL FPP TR20............13
ASD TR-75-39...........168

BI-75-9L...............212
BI-76-7................176
BRE CP-4-76.............42
BRE CP-11-76...........628
BRE CP-21-76...........146
BRE CP-22-76...........152
BRE CP-24-76............41
BRE CP-25-75...........338
BRE CP-29-75...........247
BRE CP-31-75...........256
BRE CP-32-75...........239
BRE CP-36-75...........144
BRE CP-37-75...........264
BRE CP-38-75...........245
BRE CP-42-75...........334
BRE CP-45-75...........265
BRE CP-70-75...........528
BRE G-(R6).............198
BUMINES IC-8683........336
BUMINES OFR-15-76......388
BUMINES OFR-25-76......384
BUMINES OFR-26-76......387
BUMINES OFR-27-76......386
BUMINES OFR-29-76......385
BUMINES OFR-43-76......282
BUMINES OFR-45-76......240
BUMINES OFR-77(1)-75...381
BUMINES OFR-77(2)-75...382
BUMINES OFR-83-75......383
BUMINES RI-8035........241
BUMINES TPR-87.........103
BUMINES TPR-92.........242

CEL TN-1422............470
CGR DC-32-75...........530
COM 75-10419...........120
COM 75-10608/9GA.......616
COM 75-10750...........183
COM 75-11015............69
COM 75-11018............14
CSCL 01/3..............169
CSCL 01C...............185
CSCL 06/7..............488
CSCL 06K..........489, 490
CSCL 13/12.............200

DCPA RE-24..............15
DOC CECM 3-74/2F.......179
DOC CECM 3-74/6F.......178
DOC CECM 3-74/7F.......259
DOC NO 2.10.20-3.......133
DOC NO 2.10.20-4.......177
DOD AGFSRS-75-1........327
DOD AGFSRS-75-2........328
DOD AGFSRS-75-3........531
DOD AGFSRS-75-4........532
DOD AGFSRS-75-6........326
DOD AGFSRS-76-1........469
DOT HS-801-722..........89
DOT HS-801-744.........266
DYN SCI-2310-75-118.....89
DYN SCI-2310-75-119....266

EPA DF-75/001A.........640
ER-1075-VOL-1..........489
ER-1075-VOL-2, REV A...490

FAA NA-74-57...........600
FAA NA-74-59...........332
FAA NA-75-25...........182
FAA NA-75-54...........153
FAA RD-75-37...........600
FAA RD-75-105..........332
FAA RD-75-119..........182
FAA RD-76-7............153
FDC PDC-001............477
FIRE RES NOTE 1023......90
FIRE RES NOTE 1026.....100
FIRE RES NOTE 1029......67
FIRE RES NOTE 1032.....101
FIRE RES NOTE 1033.....526
FIRE RES NOTE 1034......16
FIRE RES NOTE 1042.....529
FMRC 21011.3............92
FMRC 21011.6...........199
FMRC 22442.............337
FMRC 22445.............333
FOAC 20016-D6-A3.......106
FRA ORD-75-33..........436
FRA ORD-75-53..........211
FRC UU-42.........150, 154
FRC UU-44..............157
FRC UU-49..............158
FSGTR NC-16............342

HAN 64841...............36
HRP 0003803/4GA........612
HRP 0004532/8GA........611

IITRI J6340-FR.........243

JSC-09832..............433

ME 76-1................625

REPORT NUMBER INDEX

N00019-75-C-0172.......330
NADC 75286-40..........130
NASA CR-134885.........237
NASA CR-137690..........37
NASA CR-144561.........489
NASA CR-144562.........490
NASA CR-146363.........344
NASA CR-147496.........283
NASA TM-X-58165........433
NASA TM-X-62471........185
NBS BSS-72.............145
NBS BSS-85.............258
NBS GCR-75-50..........196
NBS GCR-75-51..........243
NBS GCR-76-60..........618
NBS SP-416-76...........59
NBS TN-666.............143
NBS TN-858.............257
NBS TN-861..............57
NBS TN-879..............68
NBSIR 75-679...........120
NBSIR 75-691............69
NBSIR 75-694...........471
NBSIR 75-700...........235
NBSIR 75-710...........210
NBSIR 75-718...........183
NBSIR 75-728...........233
NBSIR 75-736............14
NBSIR 75-782...........195
NBSIR 75-784...........667
NBSIR 75-788...........181
NBSIR 75-794...........187
NBSIR 75-901...........156
NBSIR 75-902............39
NBSIR 75-903............99
NBSIR 75-920...........325
NBSIR 75-956...........244
NBSIR 75-966...........601
NBSIR 75-967...........107
NBSIR 75-971...........432
NBSIR 76-982............58
NBSIR 76-990...........331
NBSIR 76-1016..........238
NBSIR 76-1028..........231
NBSIR 76-1030..........197
NBSIR 76-1040..........236
NBSIR 76-1076...........88
NFPCA CR-76/01.........457
NRL MR-3191............132
NSF RA-760037..........468
NSF RA-760038..........458
NSF RA/E-73-191........624
NSF RA/E-75-039.........13
NSF RA/S-74-019........442
NSWC WOL TR-75-153.....329
NSWC WOL TR-75-159.....134
NTIS PS-76/0268/3GA....483
NTSB HAR-75-8...........38
NUREG-0050.............392

P-5416.................444
P-5420.................571
P-5426.................443
P-5456.................445
PAT-APPL-621 338/GA....232
PB-240 655/1GA.........442
PB-241 365/6ST.........436
PB-241 850/7ST.........359
PB-241 851/5ST.........434
PB-242 236/AS..........214
PB-242 346/AS...........66
PB-242 441/AS..........175
PB-242 582/5...........624
PB-242 624/5...........241
PB-242 953.............438
PB-243 662.............640
PB-244 971/8ST.........435
PB-245 888/3............89
PB-245 898/2GA.........381
PB-245 899/0GA.........382
PB-245 903/0GA.........383
PB-246 281/0GA.........266
PB-246 704/1GA.........336
PB-246 730/6GA.........617
PB-246 859/3GA..........99
PB-246 860/1GA.........156
PB-246 862/7GA.........667
PB-247 203/3GA.........187
PB-247 483/1GA.........243
PB-247 537/4GA.........145
PB-247 654/7GA.........244
PB-247 939/2GA.........196
PB-248 092/9GA.........457
PB-248 643/9GA.........195
PB-248 699/1GA..........58
PB-248 755/1GA.........342
PB-248 776/7GA..........38
PB-248 913/6GA.........325
PB-249 177/7GA.........475
PB-249 178/5GA.........477
PB-249 340/1GA.........388
PB-249 539/8GA..........39
PB-249 540/6GA..........59
PB-249 674/3GA.........392
PB-249 776/6GA.........432
PB-249 865/7GA.........384
PB-250 368/8GA.........386
PB-250 389/4GA.........282
PB-250 439/7GA.........577
PB-250 440/5GA.........575
PB-250 441/3GA.........576
PB-250 443/9GA.........570
PB-250 444/7GA.........572
PB-250 460/3GA.........574
PB-250 463/7GA.........459
PB-250 464/5GA.........573
PB-250 465/2GA.........569
PB-250 540/2GA.........385
PB-250 611/1GA.........387
PB-250 731/7GA.........211
PB-250 768/9GA.........601
PB-250 843/0GA.........181
PB-251 413/1GA.........107
PB-251 415/6GA.........231
PB-251 715/9GA.........240
PB-251 769/6GA.........331
PB-252 299/3GA.........468
PB-252 306/6GA.........458
PS 75/286/5ST..........641

R-1506-NYC.............568
R-1566-3-HUD...........563
R-1566-4-HUD...........573
R-1566-5-HUD...........569
R-1615-NYC-HUD.........564
R-1618-1-HUD...........565
R-1618-2-HUD...........566
R-1624-NYC.............567
R-1646-1-HUD...........570
R-1646-2-HUD...........572
R-1687-HUD.............574
R-1688-1-HUD...........575
R-1688-2-HUD...........576
R-1688-3-HUD...........577
R-1784-1-HUD...........456
R-1784-2-HUD...........459
RARDE 7/75.............186
REPT 5081-1............484

SO-6-4446-0............283
SRI PROJ PYU-8150......170
SSS R-74-2436..........211

TDC/500-74/2...........359
TDC/500-74/3...........434
TR-2...................656
TR-111.................488
TR-113-REPT 2..........485
TR-114, 3-74...........487
TR-37191-74-5..........214

UCB FRG 75-1............65
UCB FRG 75-2............66
UCB FRG 75-6...........399
UCB FRG 75-8...........175
UCB FRG 75-17..........262
UCB FRG 75-18..........437
UCB FRG 75-19..........110
UCB FRG WP 75-5........400
UCID 16916.............474
UI BMR-13..............385
UMTA DC-06-0091-75-1...438
USAC LBC2A.............477
USAC LBC2B,0620-FS-01..475
USCG D-24-76...........642
USCG D-187-75..........530
USCG NTSB-MAR-75-6......40
USNA EPRO-15...........324
UTEC 75-025.......150, 154
UTEC 75-055............157

WANL TNR-070...........155

EXPANSIONS OF JOURNAL ABBREVIATIONS

Accid Anal Prev ... Accident Analysis and Prevention

Adv Fire Retard Text, Prog Fire Retard Ser ..... Advances in Fire Retardant Textiles, Progress in Fire Retardancy Series

Allg Forstztg ... Allgemeine Forstzeitung [General Forestry Gazetteer]

Amts Mitteilungsbl Bundesanst Materialpruef ... Amts- und Mitteilungsblatt der Bundesanstalt fuer Materialpruefung [Official Gazette and Communications of the Federal Bureau for Materials Testing]

Anesth Analg ... Anesthesia and Analgesia

Ann Surg .... Annals of Surgery

Antincendio protez civ .... Antincendio e Protezione Civile [Fire and Public Protection]

Appl Ergon .... Applied Ergonomics

ASCE Proc. J Struct Div .... American Society of Civil Engineers. Proceedings. Journal of the Structural Division

ASHRAE J ... American Society of Heating, Refrigerating and Air-Conditioning Engineers

ASME Trans. Ser C. J Heat Transfer ..... American Society of Mechanical Engineers. Transactions. Series C. Journal of Heat Transfer

ASME Trans. Ser H. J Eng Mater Technol ..... American Society of Mechanical Engineers. Transactions. Series H. Journal of Engineering Materials and Technology

BBC-Nachr .. Brown-Boveri und Compagnie - Nachrichten [Bulletin of the Brown-Bovari Company]

Bezop tr prom-sti ... Bezopasnost truda v promyshlennosti [Occupational Safety in Industry]

Brandforsvar . Brandforsvar [Fire Protection]

Brandschutz ... Brandschutz [Fire Protection]

Cah Cent Sci Tech Batim ...... Cahiers du Centre Scientifique et Technique du Batiment [Communications of the Scientific and Technical Building Center]

Chem-Ing-Tech .. Chemie-Ingenieur-Technik [Chemistry-Engineer-Technology]

Chem Tech ... Chemische Technik [Chemical Engineering]

Combust Sci Technol .. Combustion Science and Technology

Cour Norm .. Courrier de la Normalisation [Standardization Bulletin]

Dtsche Farben Z ... Deutsche Farben-Zeitschrift [German Paint Journal]

Electr Commun .. Electrical Communication

Electron Ind .... Electronics in Industry

Electron Power .... Electronics and Power

Elektrotech Z ... Elektrotechnische Zeitschrift [Elektrotechnical Journal]

Elektr Stn ..... Elektricheskiye Stantsii [Electrical Power Stations]

Eng Min J .... Engineering and Mining Journal

Environ Health Perspect ... Environmental Health Perspectives

Exchange .... Exchange

Fire .... Fire

Fire Chief .... Fire Chief

Fire Command .... Fire Command

Fire Eng .... Fire Engineering

Fire Eng J .... Fire Engineers Journal

Fire Int .... Fire International

Fire J .... Fire Journal

Fire Prev .... Fire Prevention

Fire Prev Sci Technol ... Fire Prevention Science and Technology

Fire Prot Rev .... Fire Protection Review

Fire Technol .... Fire Technology

For Sci .... Forest Science

Gorno spasat delo ... Gorno spasatel'noye delo [Mine Rescue]

Hydrocarbon Process . Hydrocarbon Processing

IEEE Proc ... Institute of Electrical and Electronics Engineers. Proceedings

IEEE Trans Biomed Eng ...... Institute of Electrical and Electronics Engineers. Transactions on Biomedical Engineering

Ind Eng Chem Prod Res Dev .... Industrial and Engineering Chemistry, Product Research and Development

Ind Vernice ..... Industria della Vernice [Varnish Industry]

Inf Process Manage .. Information Processing Management

Instrum Technol .. Instrumentation Technology

ISA Trans .... Instrument Society of America. Transactions

J Am Med Assoc .. Journal of the American Medical Association

J Br Fire Serv Assoc and Ind Fire Prot Assoc .. Journal of the British Fire Service Association and the Industrial Fire Protection Association

J Chem Educ .. Journal of Chemical Education

J Combust Toxicol . Journal of Combustion Toxicology (Quarterly Supplement to the Journal of Fire and Flammability)

J Consumer Prod Flammability . Journal of Consumer Product Flammability (Quarterly Supplement to the Journal of

Fire and Flammability)

J Fire Flammability . Journal of Fire and Flammability

J Fire Retard Chem ...... Journal of Fire Retardant Chemistry (Quarterly Supplement to the Journal of Fire and Flammability)

J For .... Journal of Forestry

J Mines Met Fuels ..... Journal of Mines, Metals and Fuels

J Occup Med ..... Journal of Occupational Medicine

J Pediatr .... Journal of Pediatrics

J Polym Sci: Polym Chem Ed ... Journal of Polymer Science: Polymer Chemistry Edition

J Polym Sci: Polym Lett Ed ... Journal of Polymer Science: Polymer Letters Edition

J Prestr Concr Inst ...... Journal of the Prestressed Concrete Institute

J Soc Automot Eng Jap .... Journal of the Society of Automotive Engineers of Japan

Khim prom .. Khimicheskaya Promyshlennost [Chemical Industry]

Koatsu gasu .. Koatsu gasu/Journal of the Institute of Safety in High Pressure Gas Engineering (Japan)

Kunstst Plast ...... Kunststoffe-Plastics

Maschinenschaden .... Maschinenschaden [Machine Failure]

Melliand Textilber ..... Melliand Textilberichte [Melliand Textile Journal]

Nat Saf News .... National Safety News

Nav Eng J .... Naval Engineers Journal

Offshore Serv .... Offshore Service

Oper Res .... Operations Research

Polizei Tech Verkehr .. Polizei-Technik-Verkehr [Police and Traffic Safety Engineering Journal]

Polym Eng Sci ... Polymer Engineering and Science

Pozhar delo . Pozharnoye Delo [Firefighting]

Pozhar okhrana . Pozharnaya okhrana [Fire Protection]

Prakt Anaesth .... Praktische Anaesthesie [Practical Anesthesiology]

Prof Saf .... Professional Safety

Prom energ .... Promyshlennaya energetika [Industrial Power]

Prot Civ Secur Ind . Protection Civile et Securite Industrielle [Public Protection and Industrial Security]

Publ Pers Manage .... Public Personnel Management

Q Rep Rail Tech Res Inst (Japan) .. Quarterly Reports of the Railway Technical Research Institute (Japan)

Rep Fire Res Inst Japan .. Reports of the Fire Research Institute of Japan

Rep Fire Sci Lab (Japan) . Reports of the Fire Science Laboratory (Japan)

Rubber Age .... Rubber Age

Sb Tr VNII protivopozhar oborony .... Sbornik Trudov Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Protivopozharnoy Oborony [Digest of Papers of the All-Union Fire Protection Research Institute]

Schweiz Feuerwehr Z ...... Schweizerische Feuerwehr Zeitung [Swiss Fire Protection Journal]

Science .... Science

Sharyo to Denki . Sharyo to Denki (Japan) [Railroads and Electricity]

Siemens Z .. Siemens Zeitschrift [Siemens Journal]

Stahl Eisen .. Stahl und Eisen [Steel and Iron]

Surg Clin North Am .. Surgical Clinics of North America

Tech Mod ...... Technique Moderne [Modern Technology]

Telecommun J .. Telecommunication Journal

Tr Inzh-ekon Fak Rizh Politekhn In-ta ... Trudy Inzhenerno-Ekonomicheskogo Fakul'teta Rizhskogo Politekhnicheskogo Instituta [Transactions of the Faculty of Engineering Economics of the Riga Polytechnic Institute]

Text Chem Color ..... Textile Chemist and Colorist

Text Inst Ind ..... Textile Institute and Industry

Text Res J ..... Textile Research Journal

VFDB Z .. Zeitschrift der Vereinigung zur Foerderung des Deutschen Brandschutzes [Journal of the Association for the Advancement of Fire Protection in Germany]

Vopr ekon pozhar okhrane .... Voprosy ekonomiki v pozharnoy okhrane [Problems of Economics in Fire Protection]

Zentralbl Arbeitsmed Arbeitsschutz ... Zentralblatt fuer Arbeitsmedizin und Arbeitsschutz [Journal of Industrial Medicine and Occupational Safety]

NATIONAL FIRE PREVENTION AND CONTROL ADMINISTRATION

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